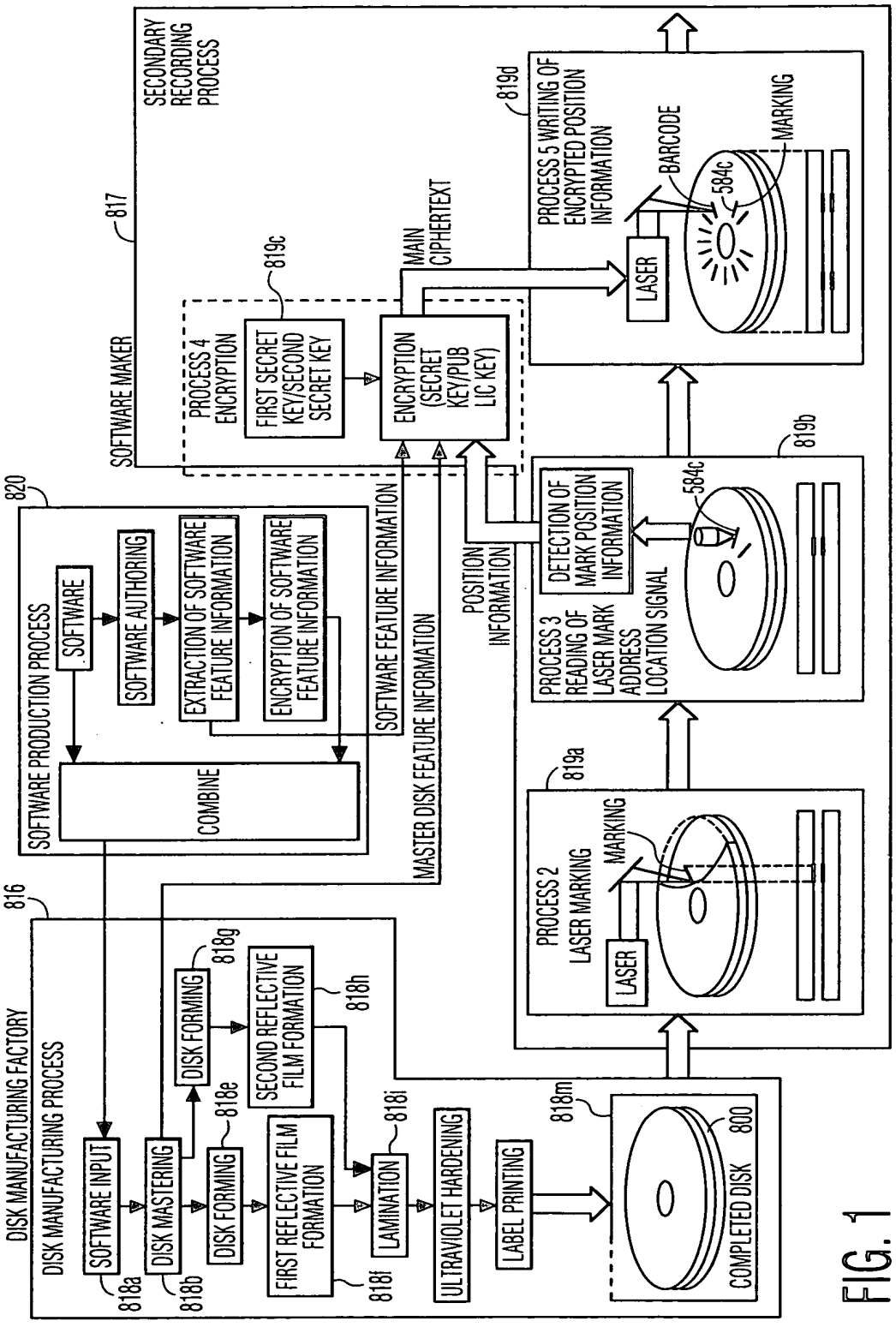

DISK MANUFACTURING FACTORY
816
DISK MANUFACTURING PROCESS
SOFTWARE INPUT
818a
DISK MASTERING
818b
DISK FORMING
818c
FIRST REFLECTIVE FILM FORMATION
818f
LAMINATION
818i
ULTRAVIOLET HARDENING
LABEL PRINTING
818m
COMPLETED DISK
800
DISK FORMING
818g
SECOND REFLECTIVE FILM FORMATION
818h
SOFTWARE PRODUCTION PROCESS
820
SOFTWARE
SOFTWARE AUTHORING
EXTRACTION OF SOFTWARE FEATURE INFORMATION
ENCRYPTION OF SOFTWARE FEATURE INFORMATION
COMBINE
SOFTWARE FEATURE INFORMATION
MASTER DISK FEATURE INFORMATION
SOFTWARE MAKER
817
SECONDARY RECORDING PROCESS
PROCESS 4 ENCRYPTION
819c
FIRST SECRET KEY/SECOND SECRET KEY
ENCRYPTION (SECRET KEY/PUBLIC KEY)
MAIN CIPHERTEXT
PROCESS 2 LASER MARKING
819a
LASER
MARKING
PROCESS 3 READING OF LASER MARK ADDRESS LOCATION SIGNAL
819b
584c
DETECTION OF MARK POSITION INFORMATION
POSITION INFORMATION
PROCESS 5 WRITING OF ENCRYPTED POSITION INFORMATION
819d
LASER
BARCODE
584c
MARKING

FIG. 1

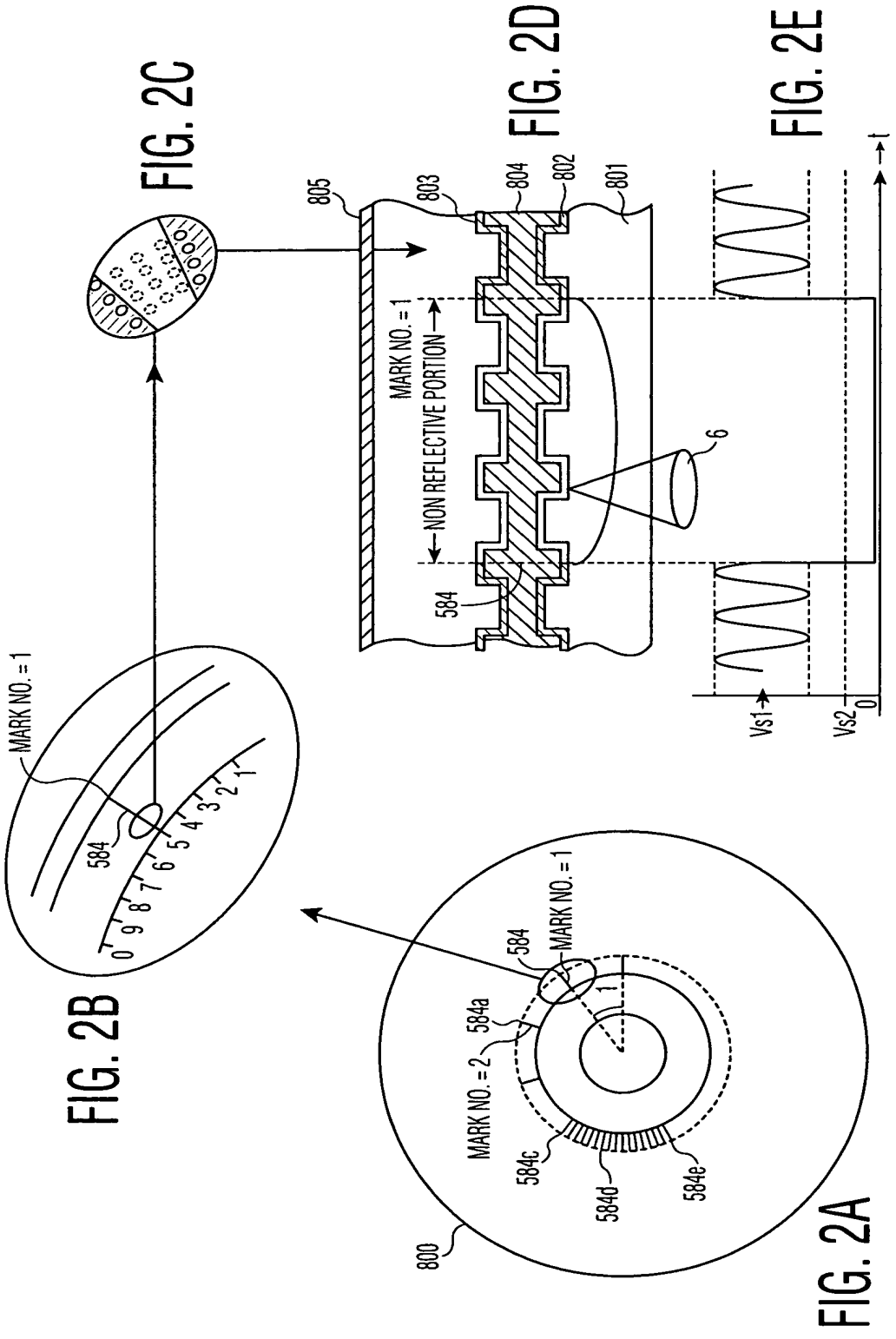


FIG. 2A
FIG. 2B
FIG. 2C
FIG. 2D
FIG. 2E
800
584
MARK NO. = 1
MARK NO. = 2
584a
584c
584d
584e
805
803
804
802
801
NON REFLECTIVE PORTION
6
Vs1
Vs2
t
0

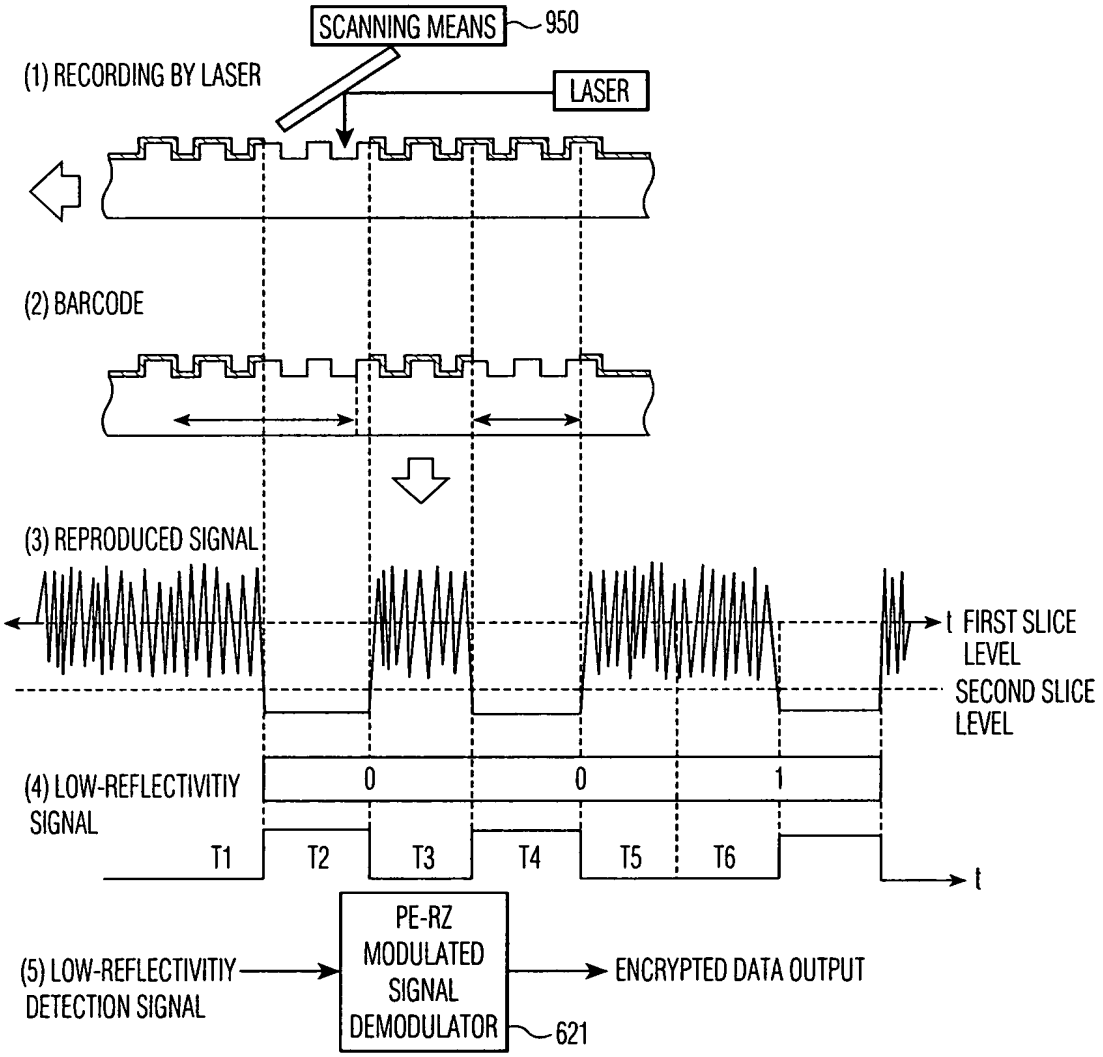

SCANNING MEANS
950
(1) RECORDING BY LASER
LASER
(2) BARCODE
(3) REPRODUCED SIGNAL
t
FIRST SLICE LEVEL
SECOND SLICE LEVEL
(4) LOW-REFLECTIVITIY SIGNAL
0
0
1
T1
T2
T3
T4
T5
T6
t
(5) LOW-REFLECTIVITIY DETECTION SIGNAL
PE-RZ MODULATED SIGNAL DEMODULATOR
621
ENCRYPTED DATA OUTPUT

FIG. 3

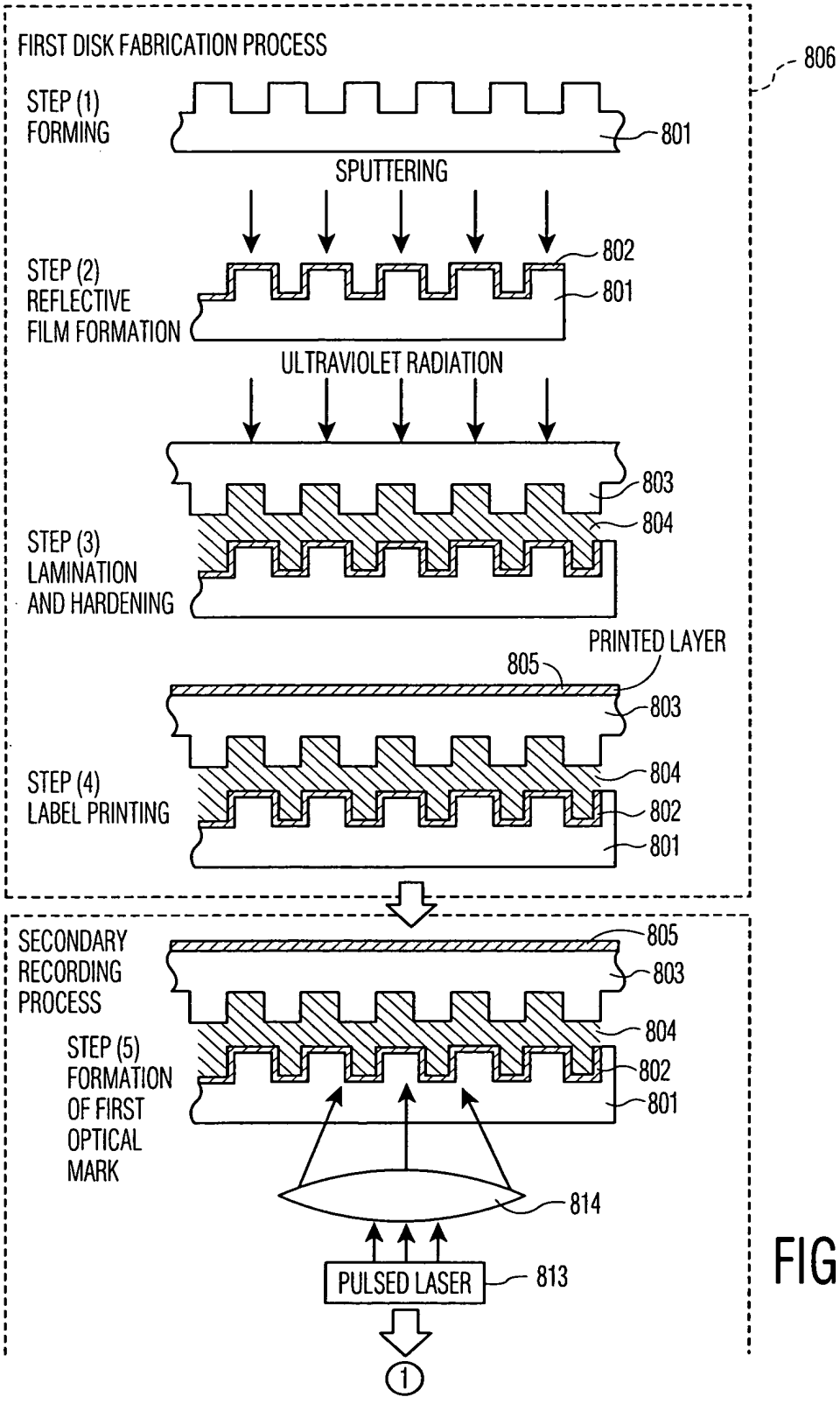

FIRST DISK FABRICATION PROCESS
806
STEP (1)
FORMING
801
SPUTTERING
802
STEP (2)
REFLECTIVE
FILM FORMATION
801
ULTRAVIOLET RADIATION
803
804
STEP (3)
LAMINATION
AND HARDENING
PRINTED LAYER
805
803
804
STEP (4)
LABEL PRINTING
802
801
SECONDARY
RECORDING
PROCESS
805
803
804
STEP (5)
FORMATION
OF FIRST
OPTICAL
MARK
802
801
814
PULSED LASER
813
1

FIG. 4

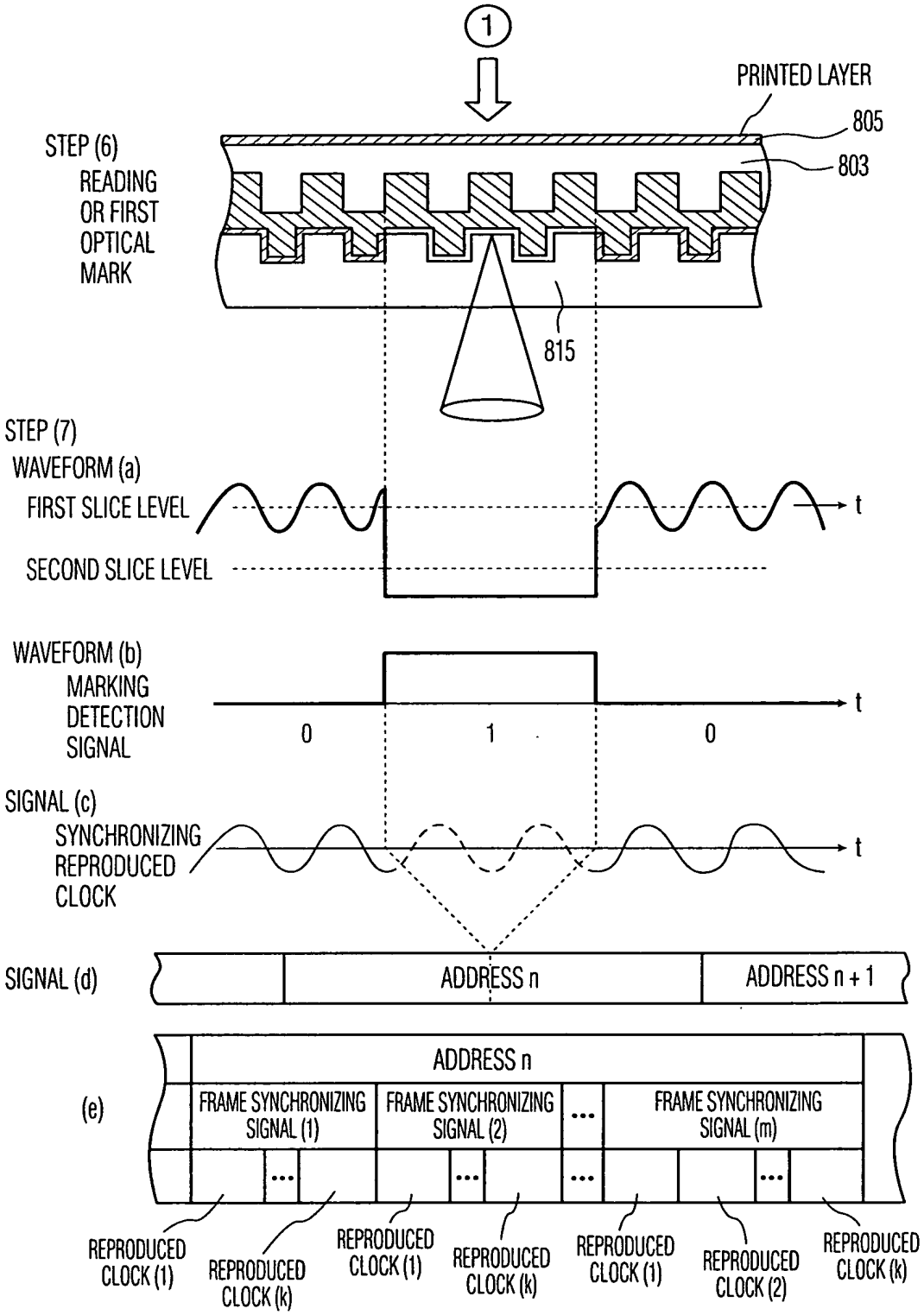

1
PRINTED LAYER
805
803
STEP (6)
READING OR FIRST OPTICAL MARK
815
STEP (7)
WAVEFORM (a)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
t
WAVEFORM (b)
MARKING DETECTION SIGNAL
0
1
0
t
SIGNAL (c)
SYNCHRONIZING REPRODUCED CLOCK
t
SIGNAL (d)
ADDRESS n
ADDRESS n + 1
(e)
ADDRESS n
FRAME SYNCHRONIZING SIGNAL (1)
FRAME SYNCHRONIZING SIGNAL (2)
FRAME SYNCHRONIZING SIGNAL (m)
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (k)
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (k)
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (2)
REPRODUCED CLOCK (k)

FIG. 5

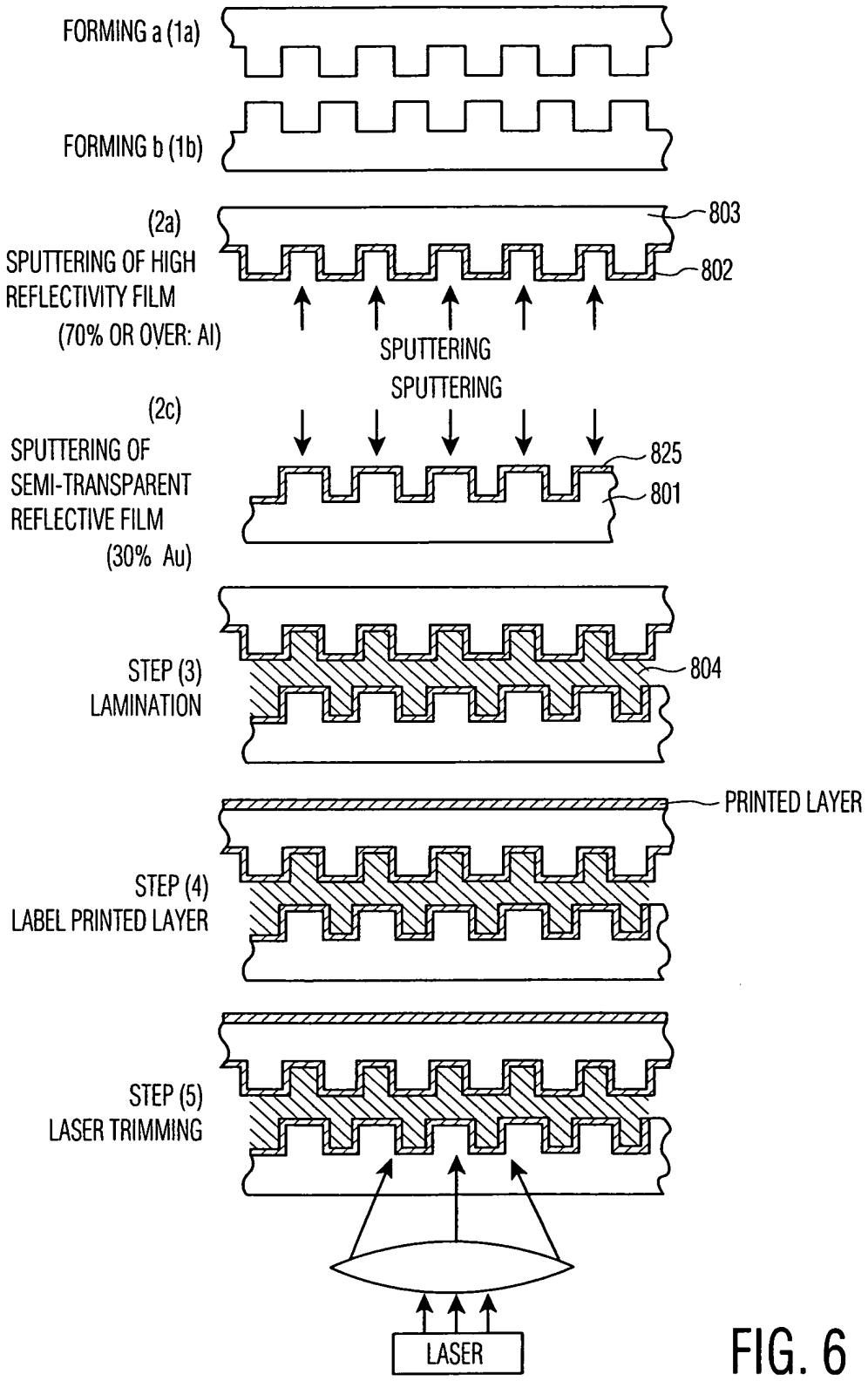

FORMING a (1a)
FORMING b (1b)
(2a)
SPUTTERING OF HIGH REFLECTIVITY FILM (70% OR OVER: Al)
803
802
SPUTTERING
SPUTTERING
(2c)
SPUTTERING OF SEMI-TRANSPARENT REFLECTIVE FILM (30% Au)
825
801
STEP (3) LAMINATION
804
PRINTED LAYER
STEP (4) LABEL PRINTED LAYER
STEP (5) LASER TRIMMING
LASER

FIG. 6

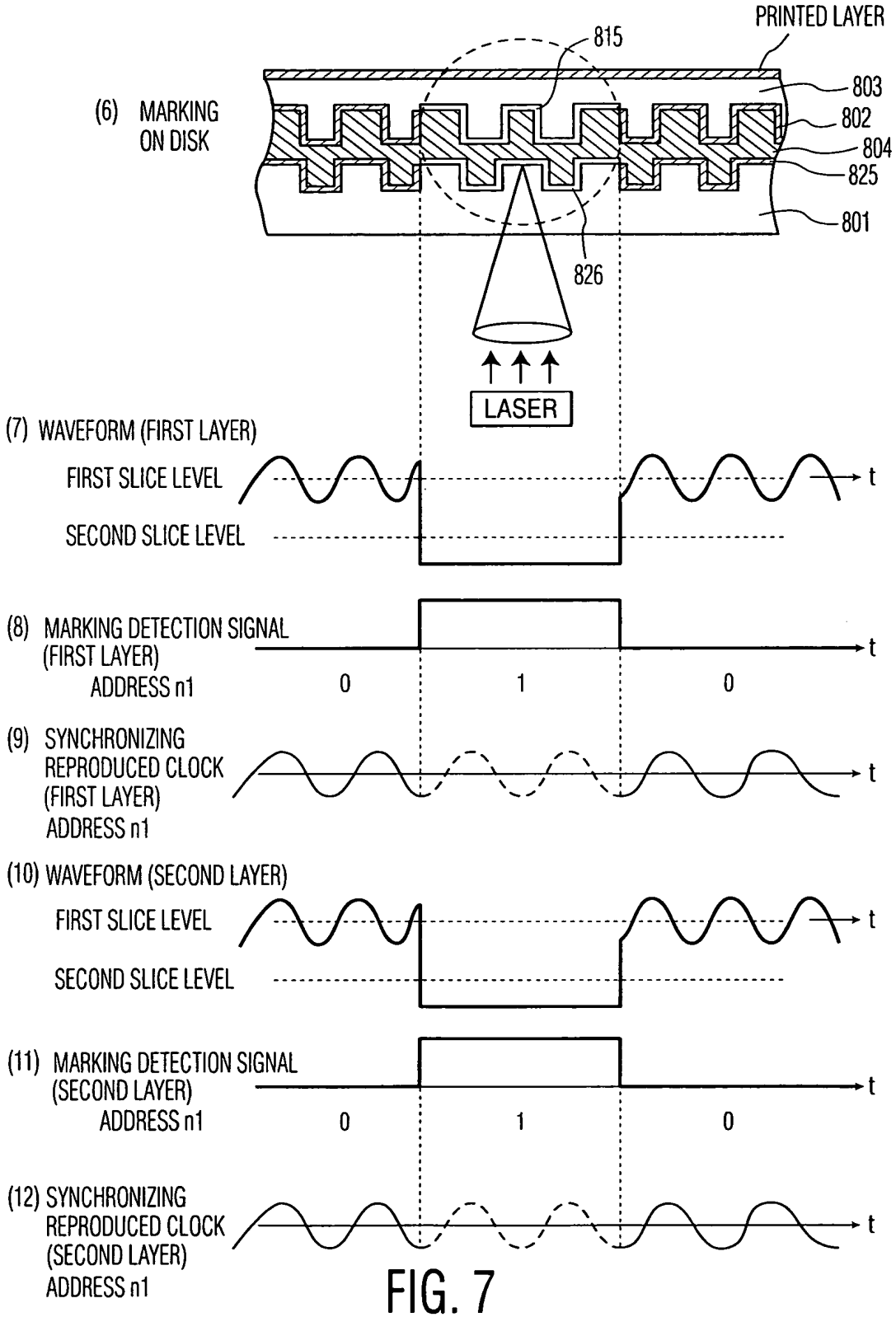

(6) MARKING ON DISK
PRINTED LAYER
815
803
802
804
825
801
826
LASER
(7) WAVEFORM (FIRST LAYER)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
t
(8) MARKING DETECTION SIGNAL (FIRST LAYER)
ADDRESS n1
0
1
0
(9) SYNCHRONIZING REPRODUCED CLOCK (FIRST LAYER)
ADDRESS n1
(10) WAVEFORM (SECOND LAYER)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
(11) MARKING DETECTION SIGNAL (SECOND LAYER)
ADDRESS n1
0
1
0
(12) SYNCHRONIZING REPRODUCED CLOCK (SECOND LAYER)
ADDRESS n1

FIG. 7

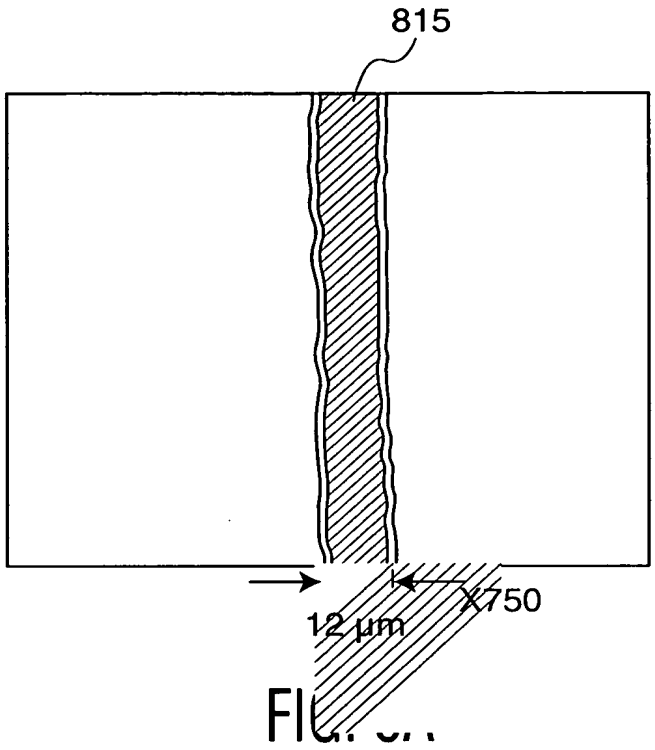


FIG. 8A

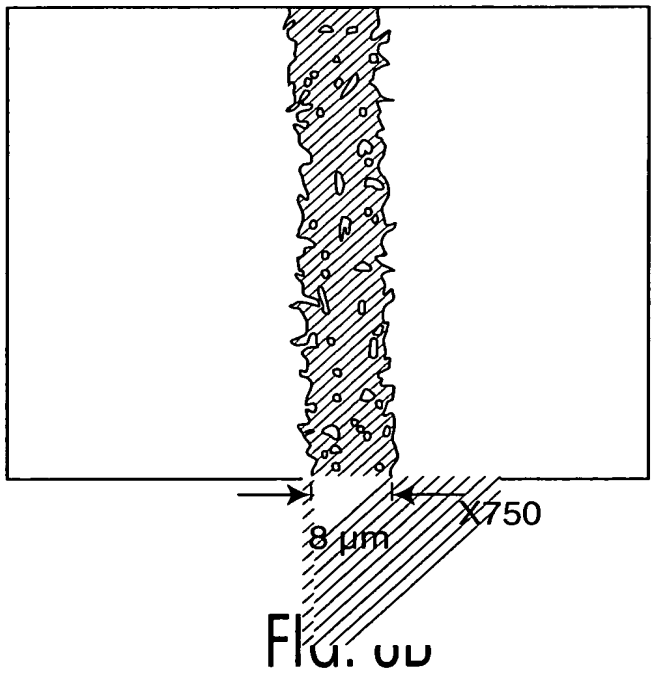


FIG. 8B

FIG. 9A

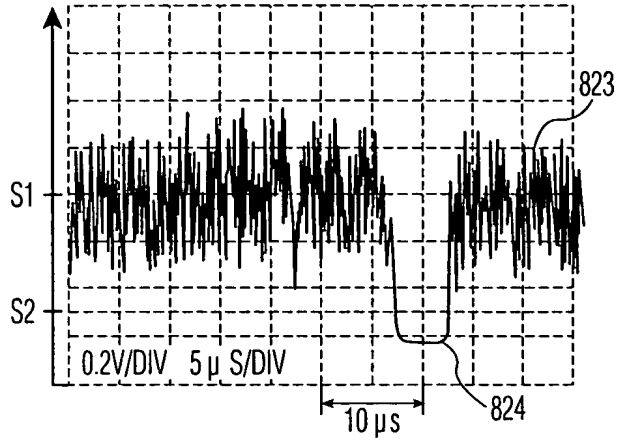


FIG. 9B

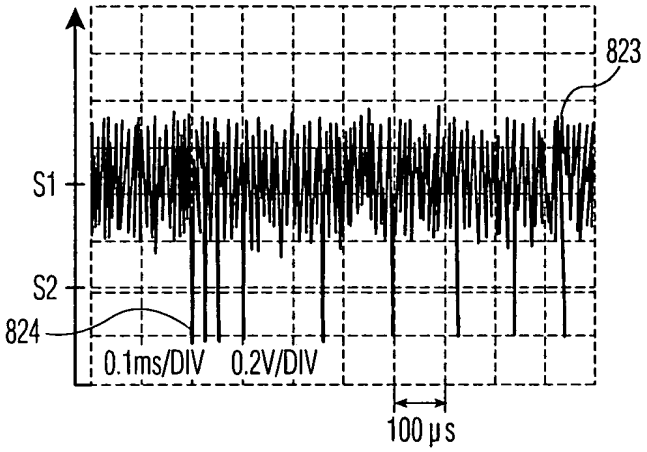


FIG. 9C

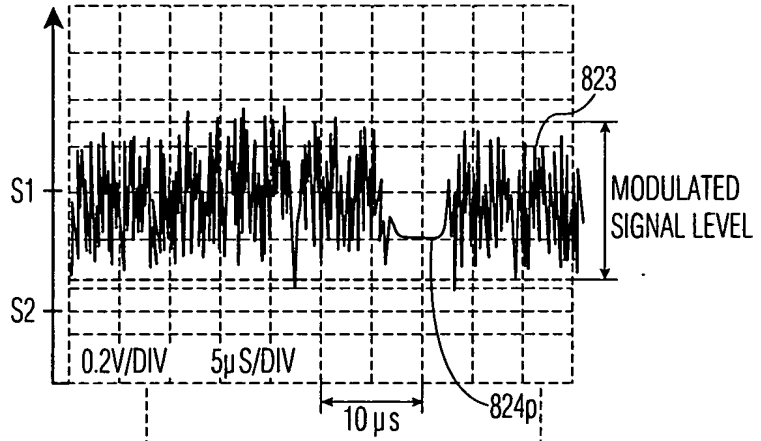
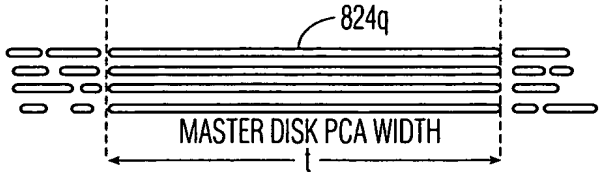


FIG. 9D



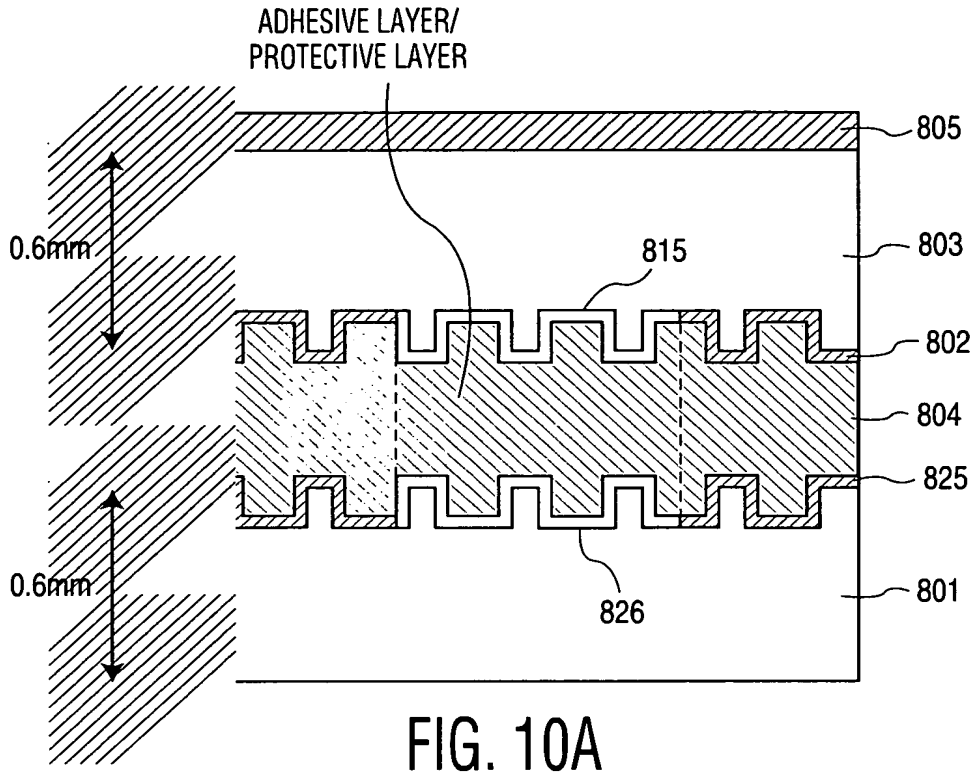


FIG. 10A

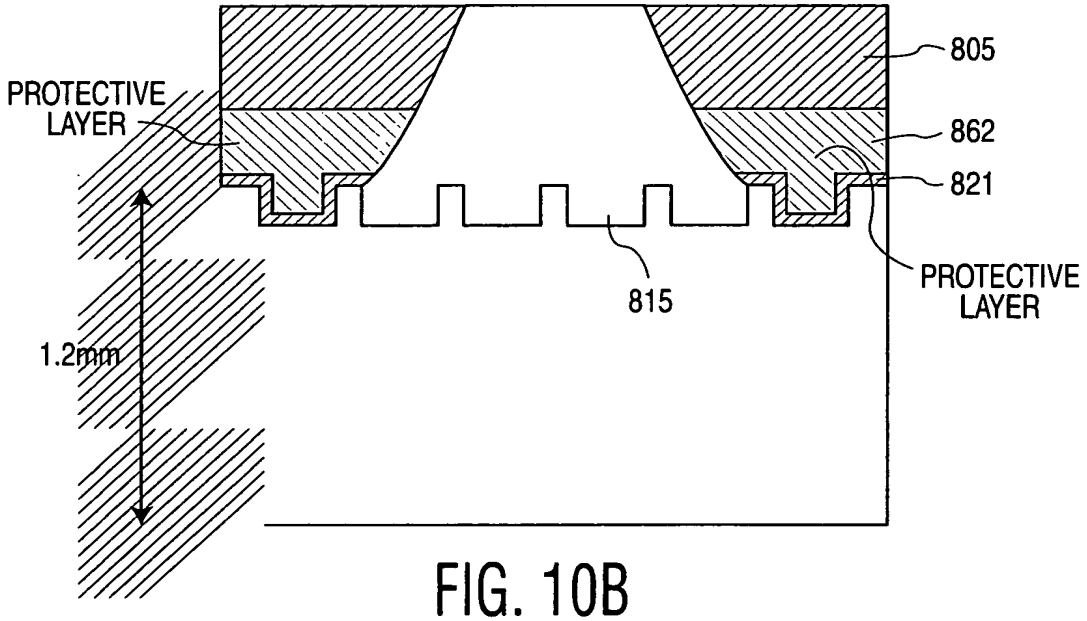


FIG. 10B

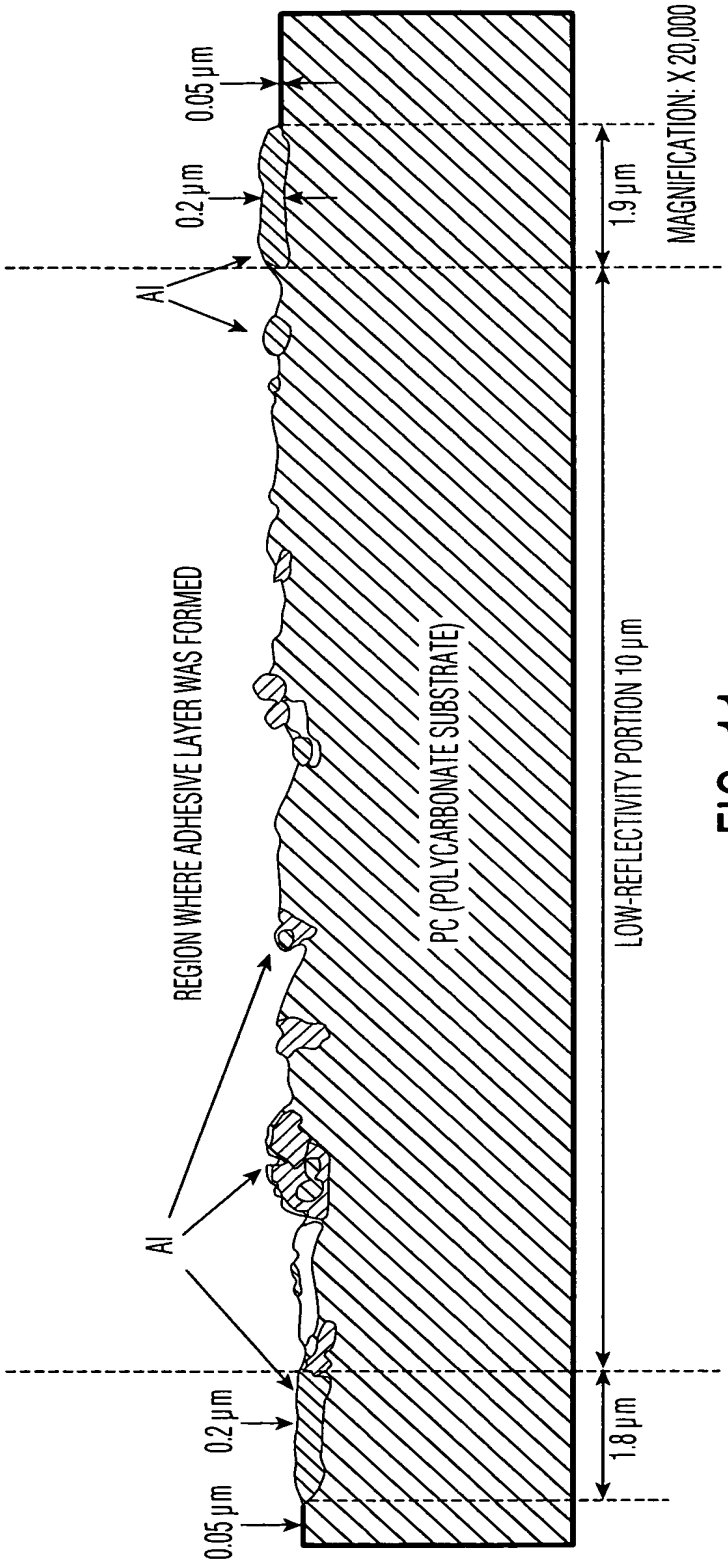

0.05 µm
0.2 µm
Al
1.9 µm
MAGNIFICATION: X 20,000
REGION WHERE ADHESIVE LAYER WAS FORMED
PC (POLYCARBONATE SUBSTRATE)
LOW-REFLECTIVITY PORTION 10 µm
Al
0.2 µm
1.8 µm
0.05 µm

FIG. 11

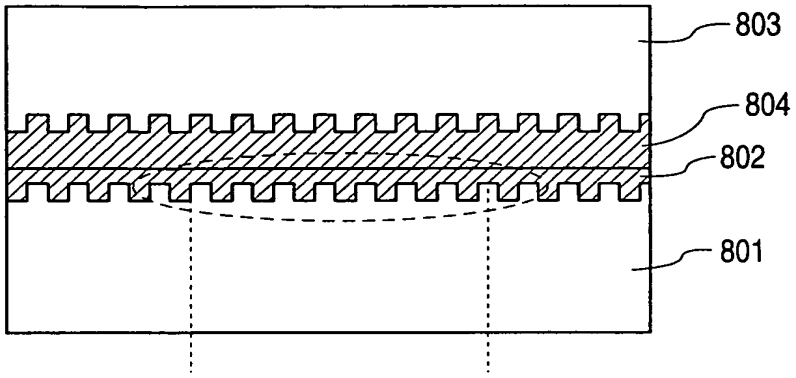


FIG. 12A

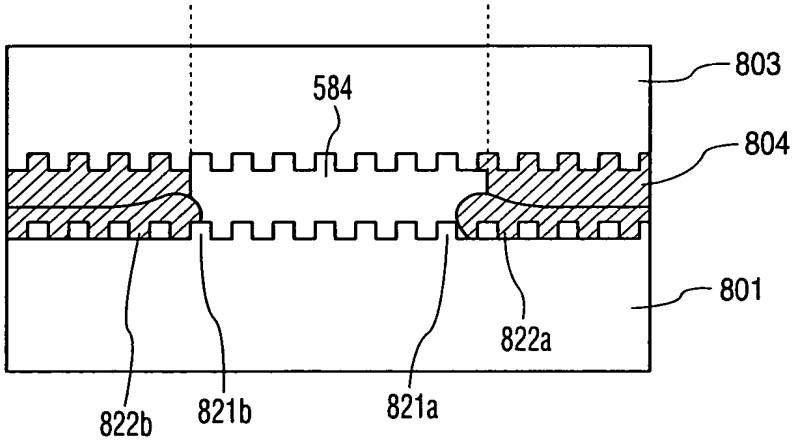


FIG. 12B

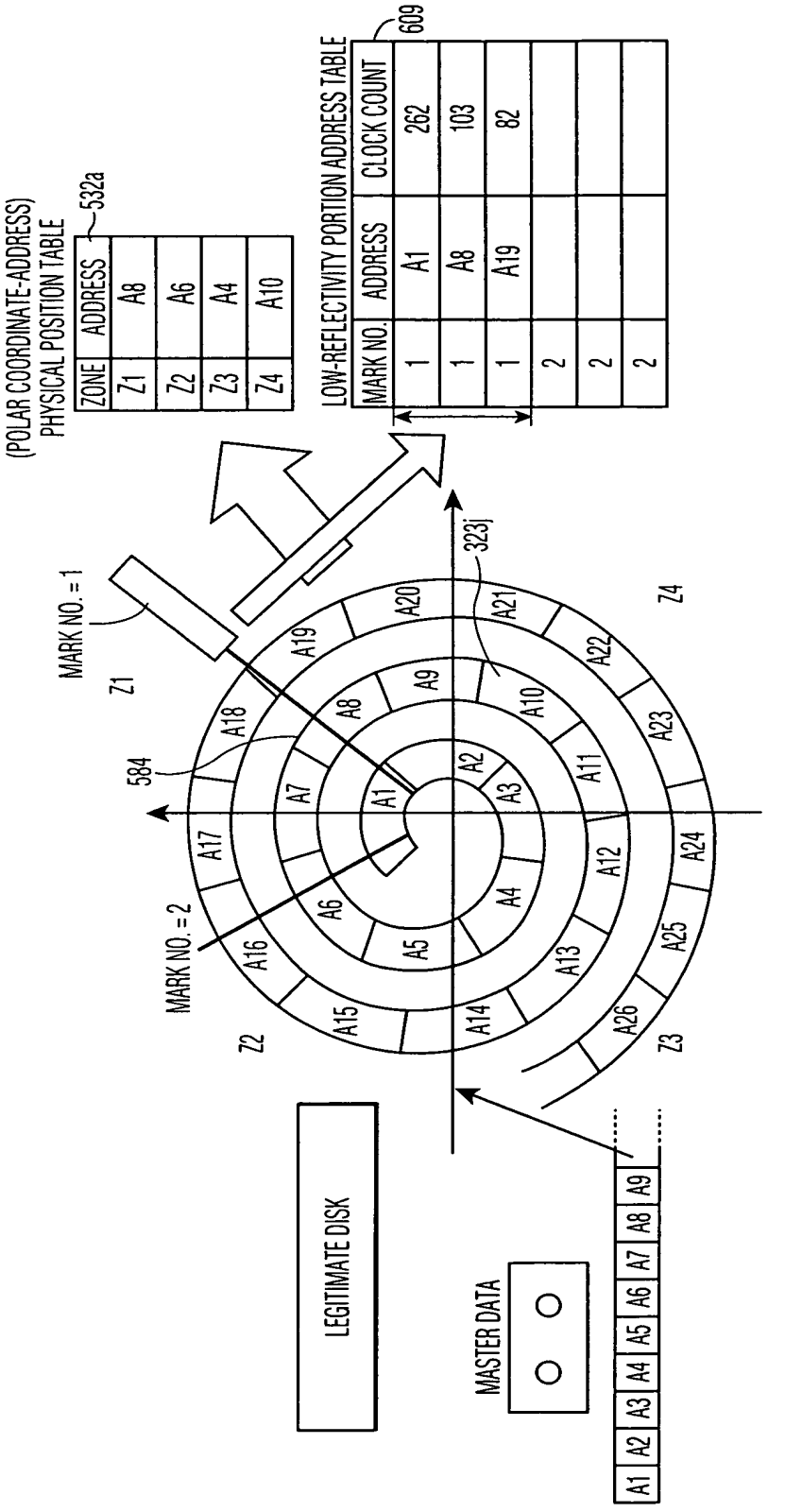

(POLAR COORDINATE-ADDRESS) PHYSICAL POSITION TABLE
532a
ZONE
ADDRESS
Z1
A8
Z2
A6
Z3
A4
Z4
A10
LOW-REFLECTIVITY PORTION ADDRESS TABLE
609
MARK NO.
ADDRESS
CLOCK COUNT
1
A1
262
1
A8
103
1
A19
82
2
2
2
MARK NO. = 1
MARK NO. = 2
584
323j
Z1
Z2
Z3
Z4
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24
A25
A26
LEGITIMATE DISK
MASTER DATA
A1
A2
A3
A4
A5
A6
A7
A8
A9

FIG. 13A

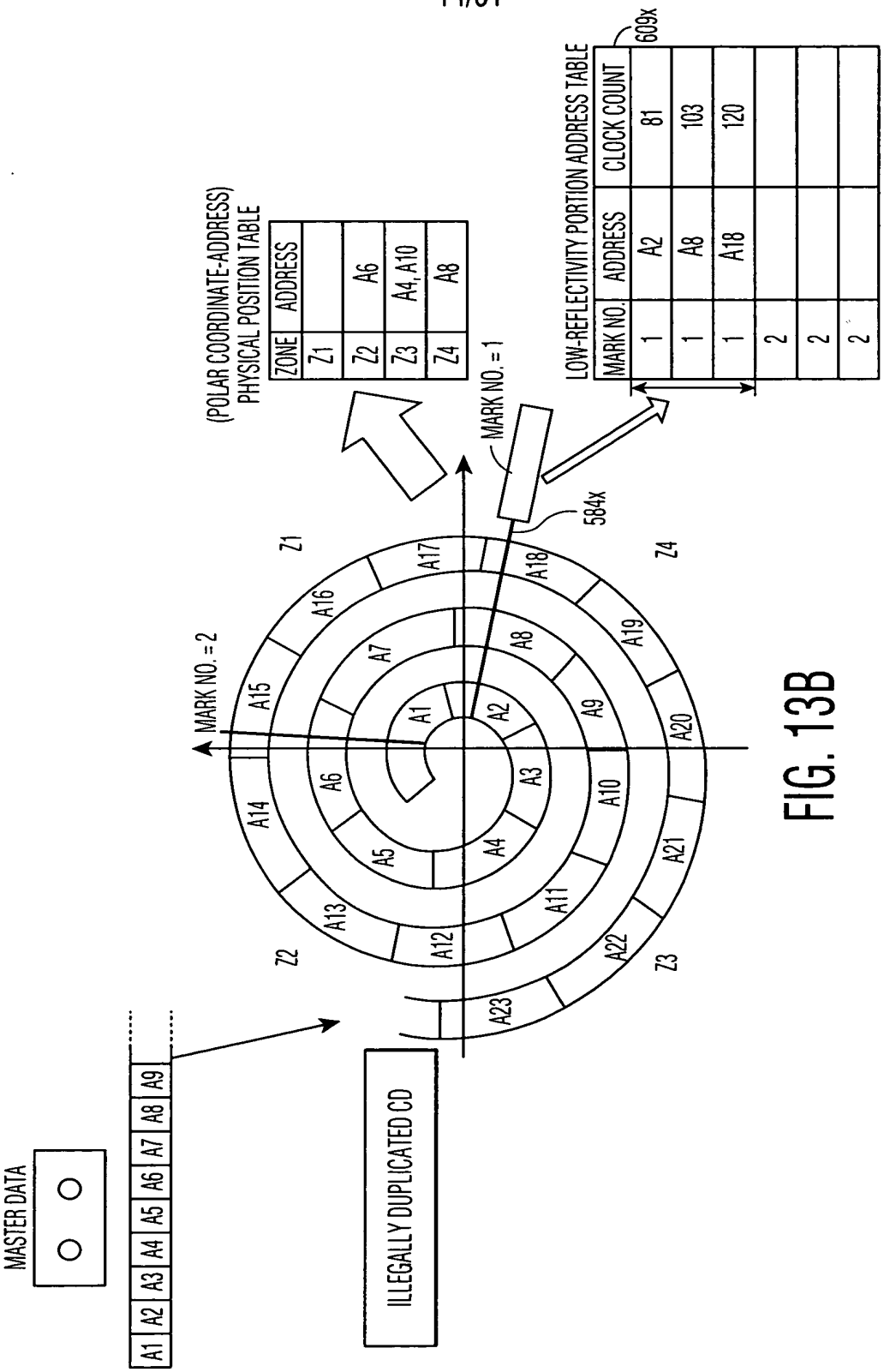

MASTER DATA
A1 A2 A3 A4 A5 A6 A7 A8 A9
ILLEGALLY DUPLICATED CD
(POLAR COORDINATE-ADDRESS) PHYSICAL POSITION TABLE
ZONE | ADDRESS
Z1 |
Z2 | A6
Z3 | A4, A10
Z4 | A8
LOW-REFLECTIVITY PORTION ADDRESS TABLE
609x
MARK NO. | ADDRESS | CLOCK COUNT
1 | A2 | 81
1 | A8 | 103
1 | A18 | 120
2
2
2
MARK NO. = 1
584x
MARK NO. = 2
Z1
Z2
Z3
Z4
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23

FIG. 13B

FIG. 14A
FIG. 14B
FIG. 14C
FIG. 14D

FIG. 14

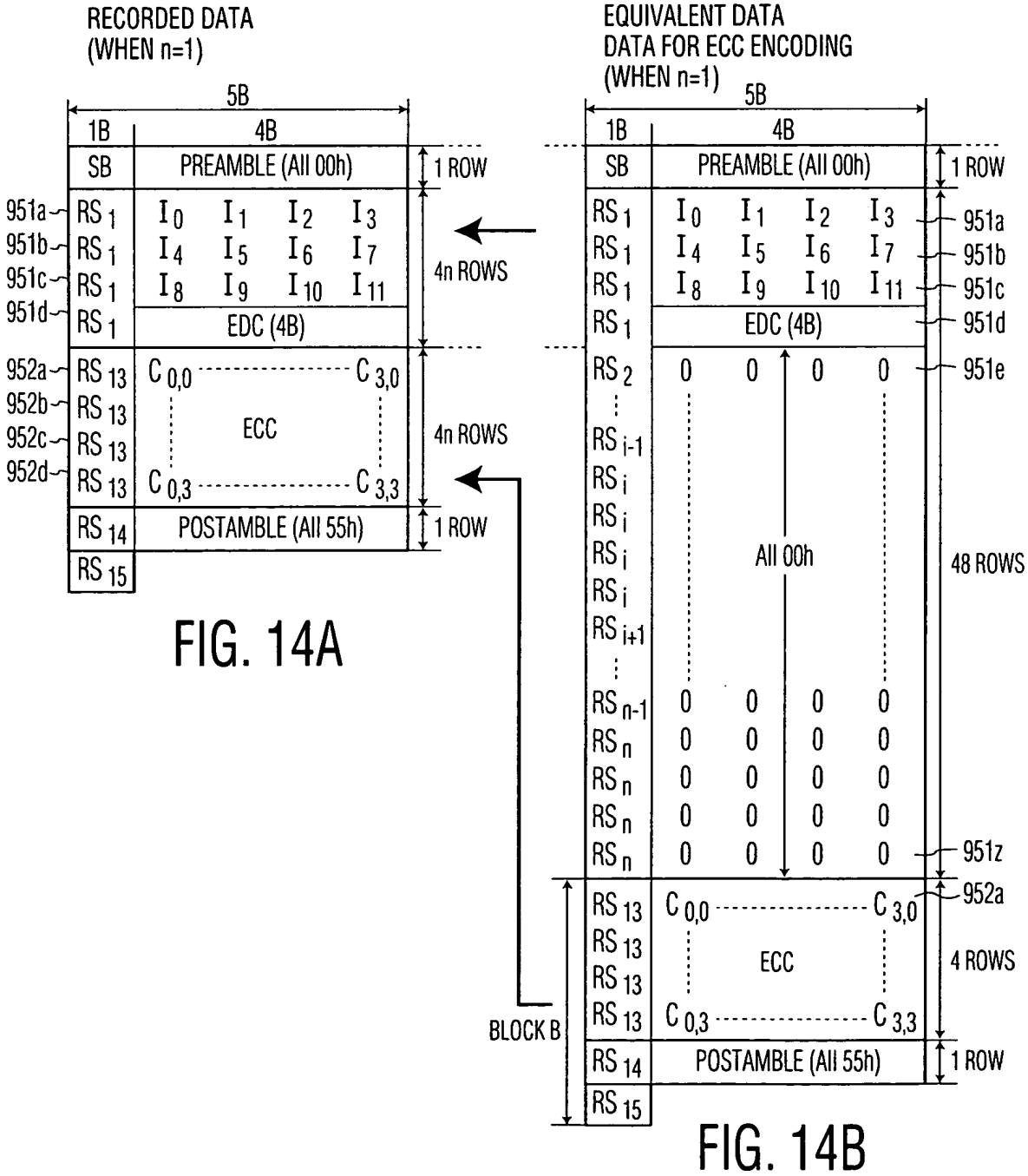


FIG. 14A

FIG. 14B

TYPICAL EQUATION
FOR EDC COMPUTATION
EDC (ERROR DETECTION CODE) :

$$EDC_{PCA}(x)=\sum_{i=0}^{31} bi \cdot x^i$$

$$I_{PCA}(x)=\sum_{i=32}^{128n-31} bi \cdot x^i$$

FIG. 14C

TYPICAL EQUATION
FOR EDC COMPUTATION
ECC (ERROR CORRECTION CODE) :

$$R_{PCA}(x)=\sum_{i=48}^{51} I_{j+4i} \cdot x^{51-i}$$

$$I_{PCA}(x)=\sum_{i=0}^{4n-2} I_{j+4i} \cdot x^{51-i} + D_j \cdot x^{52-4n},$$

FIG. 14D

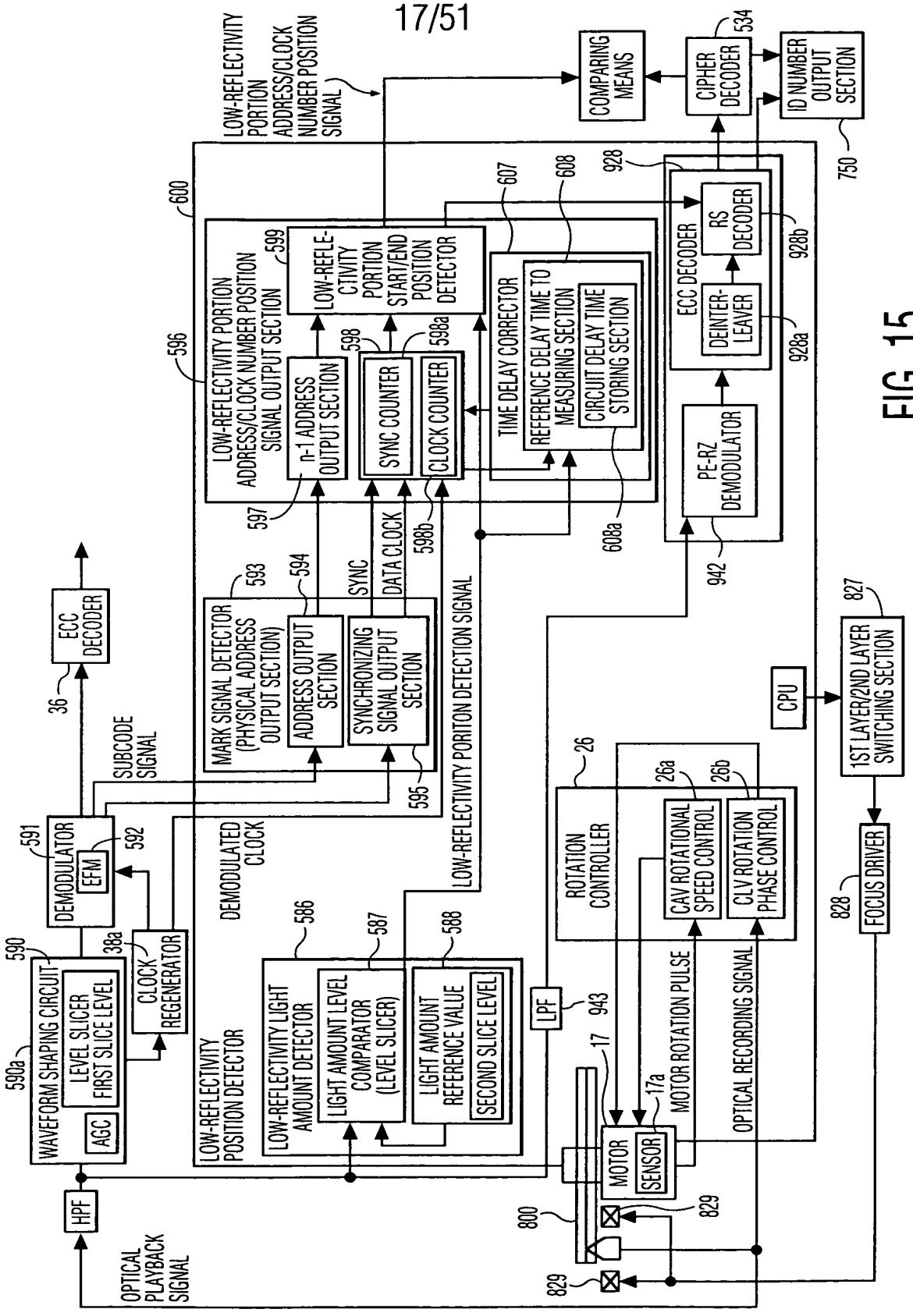

OPTICAL PLAYBACK SIGNAL
HPF
WAVEFORM SHAPING CIRCUIT
AGC
LEVEL SLICER
FIRST SLICE LEVEL
CLOCK REGENERATOR
DEMODULATOR
EFM
ECC DECODER
SUBCODE SIGNAL
DEMODULATED CLOCK
LOW-REFLECTIVITY POSITION DETECTOR
LOW-REFLECTIVITY LIGHT AMOUNT DETECTOR
LIGHT AMOUNT LEVEL COMPARATOR (LEVEL SLICER)
LIGHT AMOUNT REFERENCE VALUE
SECOND SLICE LEVEL
LOW-REFLECTIVITY PORITON DETECTION SIGNAL
LPF
MOTOR
SENSOR
MOTOR ROTATION PULSE
OPTICAL RECORDING SIGNAL
ROTATION CONTROLLER
CAV ROTATIONAL SPEED CONTROL
CLV ROTATION PHASE CONTROL
FOCUS DRIVER
1ST LAYER/2ND LAYER SWITCHING SECTION
CPU
MARK SIGNAL DETECTOR (PHYSICAL ADDRESS OUTPUT SECTION)
ADDRESS OUTPUT SECTION
SYNCHRONIZING SIGNAL OUTPUT SECTION
SYNC
DATA CLOCK
LOW-REFLECTIVITY PORTION ADDRESS/CLOCK NUMBER POSITION SIGNAL OUTPUT SECTION
n-1 ADDRESS OUTPUT SECTION
SYNC COUNTER
CLOCK COUNTER
LOW-REFLECTIVITY PORTION START/END POSITION DETECTOR
TIME DELAY CORRECTOR
REFERENCE DELAY TIME TO MEASURING SECTION
CIRCUIT DELAY TIME STORING SECTION
PE-RZ DEMODULATOR
ECC DECODER
DEINTER-LEAVER
RS DECODER
CIPHER DECODER
ID NUMBER OUTPUT SECTION
COMPARING MEANS
LOW-REFLECTIVITY PORTION ADDRESS/CLOCK NUMBER POSITION SIGNAL
600
596
597
598
598a
598b
599
607
608
608a
928
928a
928b
942
750
534
827
828
829
800
943
17
17a
26
26a
26b
590
590a
591
592
593
594
595
586
587
588
38a
36

FIG. 15

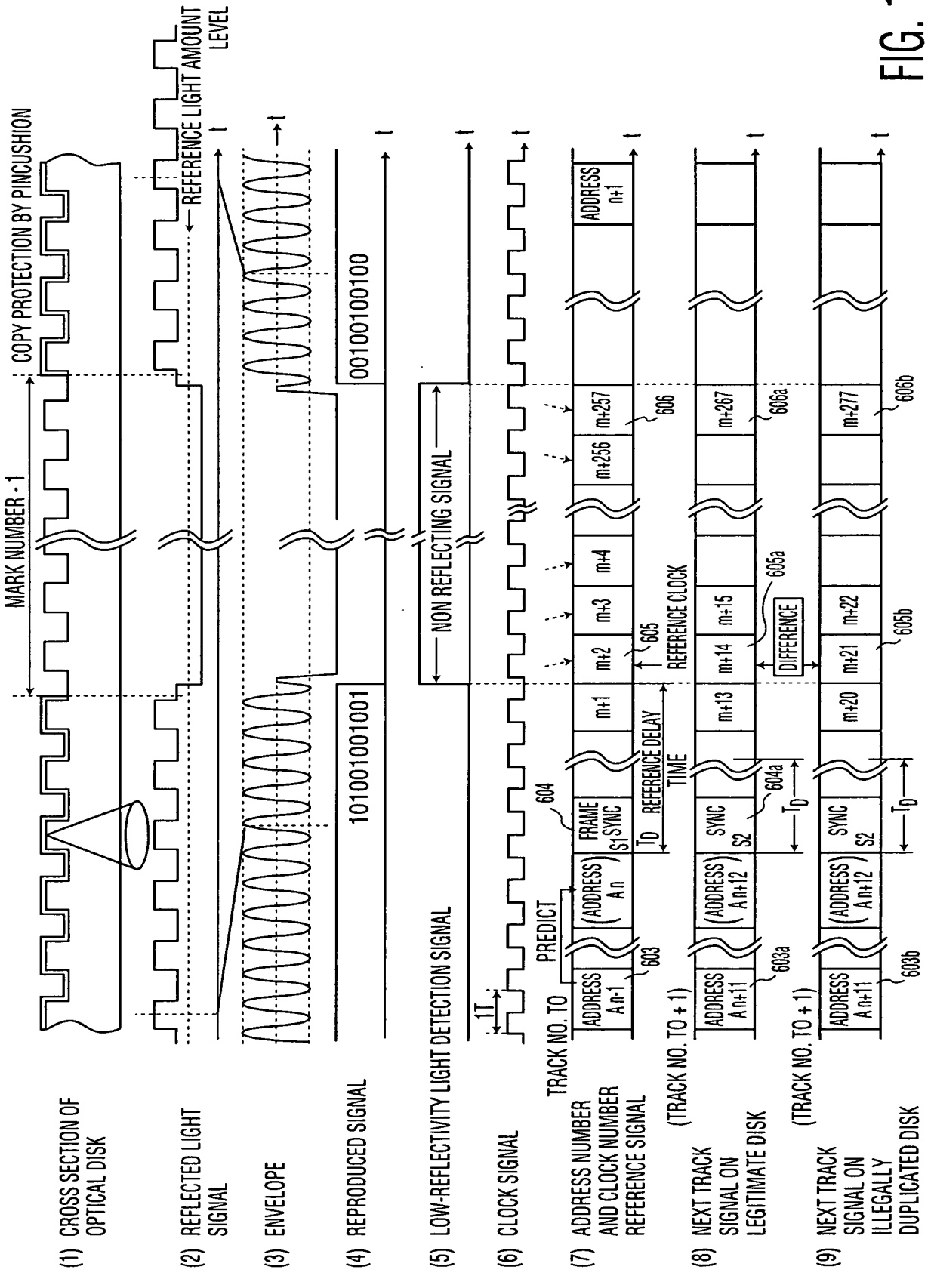

(1) CROSS SECTION OF OPTICAL DISK
MARK NUMBER - 1
COPY PROTECTION BY PINCUSHION
(2) REFLECTED LIGHT SIGNAL
REFERENCE LIGHT AMOUNT LEVEL
(3) ENVELOPE
(4) REPRODUCED SIGNAL
1010010010 01
0010010010 0
(5) LOW-REFLECTIVITY LIGHT DETECTION SIGNAL
NON REFLECTING SIGNAL
(6) CLOCK SIGNAL
1T
(7) ADDRESS NUMBER AND CLOCK NUMBER REFERENCE SIGNAL
TRACK NO. TO
PREDICT
604
ADDRESS An-1
603
(ADDRESS) An
FRAME SYNC S1
m+1
m+2
m+3
m+4
m+256
m+257
ADDRESS n+1
606
605
REFERENCE DELAY TIME
TD
REFERENCE CLOCK
(TRACK NO. TO + 1)
(8) NEXT TRACK SIGNAL ON LEGITIMATE DISK
ADDRESS An+11
603a
(ADDRESS) An+12
SYNC S2
604a
m+13
m+14
m+15
m+267
606a
605a
DIFFERENCE
(TRACK NO. TO + 1)
(9) NEXT TRACK SIGNAL ON ILLEGALLY DUPLICATED DISK
ADDRESS An+11
603b
(ADDRESS) An+12
SYNC S2
m+20
m+21
m+22
m+277
606b
605b
t

FIG. 16

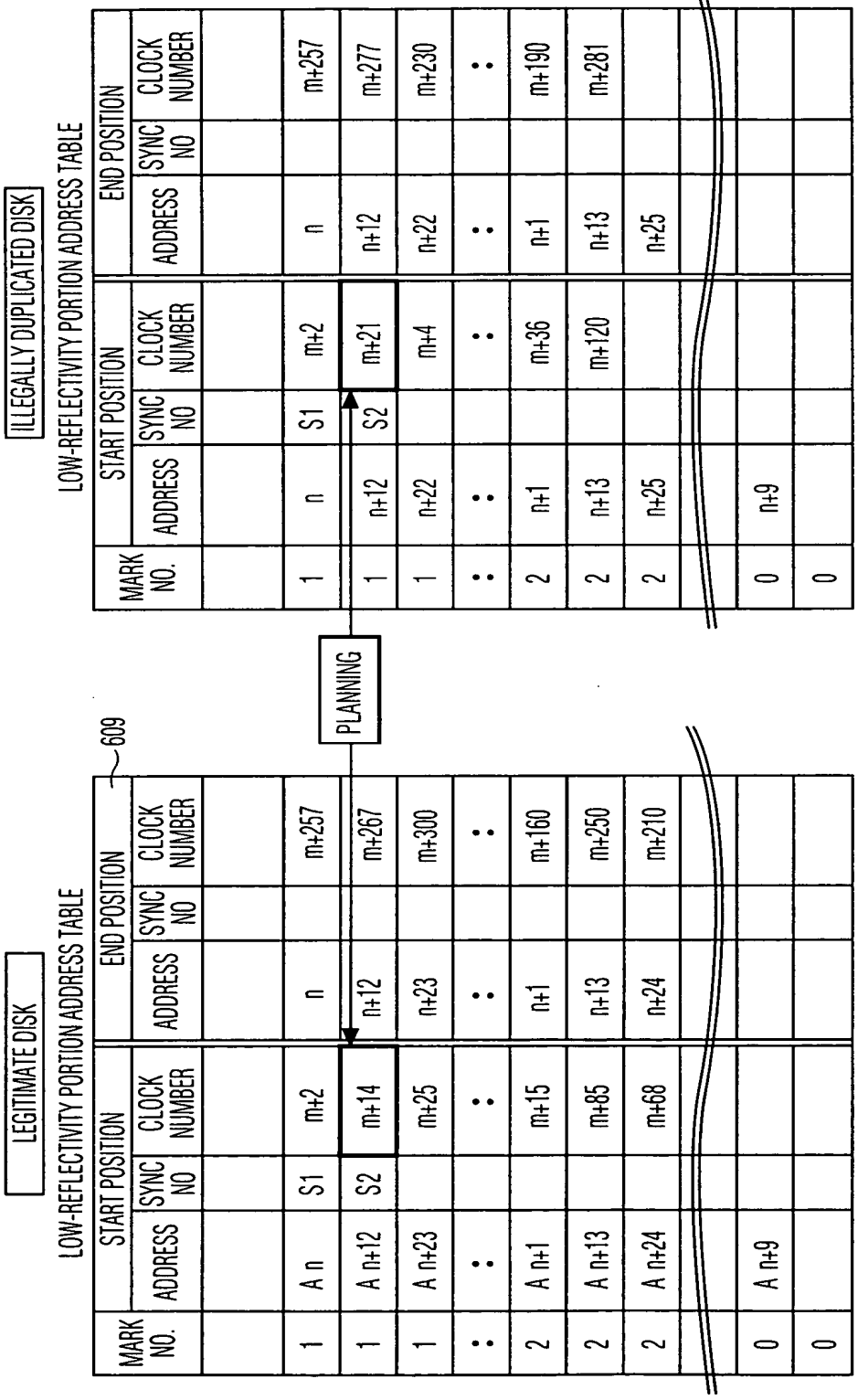

LEGITIMATE DISK
LOW-REFLECTIVITY PORTION ADDRESS TABLE
609
MARK NO.
START POSITION
ADDRESS
SYNC NO
CLOCK NUMBER
END POSITION
ADDRESS
SYNC NO
CLOCK NUMBER
1 A n S1 m+2 n m+257
1 A n+12 S2 m+14 n+12 m+267
1 A n+23 m+25 n+23 m+300
2 A n+1 m+15 n+1 m+160
2 A n+13 m+85 n+13 m+250
2 A n+24 m+68 n+24 m+210
0 A n+9 n+9
0
PLANNING
ILLEGALLY DUPLICATED DISK
LOW-REFLECTIVITY PORTION ADDRESS TABLE
MARK NO.
START POSITION
ADDRESS
SYNC NO
CLOCK NUMBER
END POSITION
ADDRESS
SYNC NO
CLOCK NUMBER
1 n S1 m+2 n m+257
1 n+12 S2 m+21 n+12 m+277
1 n+22 m+4 n+22 m+230
2 n+1 m+36 n+1 m+190
2 n+13 m+120 n+13 m+281
2 n+25 n+25
0 n+9
0

FIG. 17

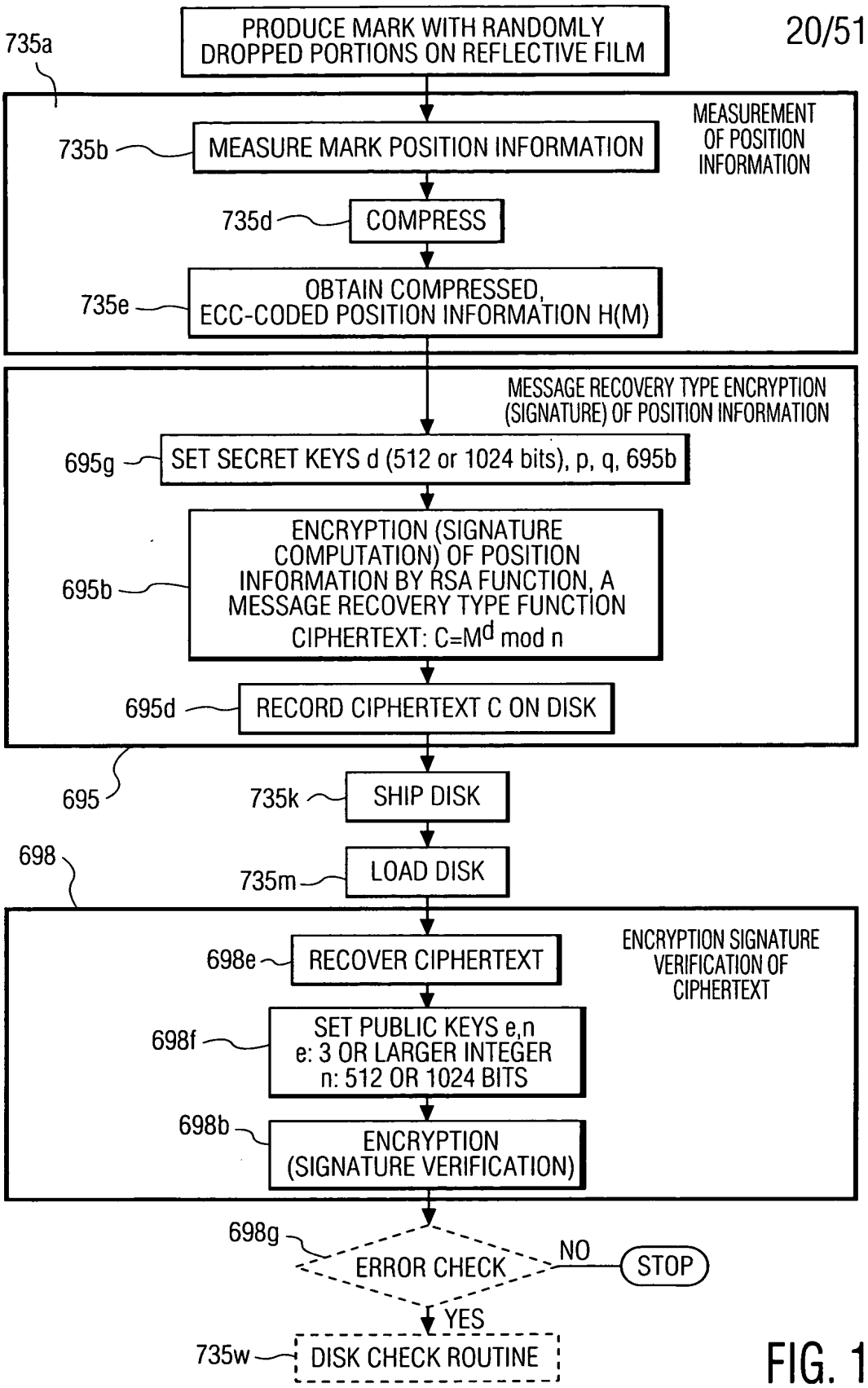

735a
PRODUCE MARK WITH RANDOMLY DROPPED PORTIONS ON REFLECTIVE FILM
MEASUREMENT OF POSITION INFORMATION
735b
MEASURE MARK POSITION INFORMATION
735d
COMPRESS
735e
OBTAIN COMPRESSED, ECC-CODED POSITION INFORMATION H(M)
MESSAGE RECOVERY TYPE ENCRYPTION (SIGNATURE) OF POSITION INFORMATION
695g
SET SECRET KEYS d (512 or 1024 bits), p, q, 695b
695b
ENCRYPTION (SIGNATURE COMPUTATION) OF POSITION INFORMATION BY RSA FUNCTION, A MESSAGE RECOVERY TYPE FUNCTION
CIPHERTEXT: C=M^d mod n
695d
RECORD CIPHERTEXT C ON DISK
695
735k
SHIP DISK
698
735m
LOAD DISK
ENCRYPTION SIGNATURE VERIFICATION OF CIPHERTEXT
698e
RECOVER CIPHERTEXT
698f
SET PUBLIC KEYS e,n
e: 3 OR LARGER INTEGER
n: 512 OR 1024 BITS
698b
ENCRYPTION (SIGNATURE VERIFICATION)
698g
ERROR CHECK
NO
STOP
YES
735w
DISK CHECK ROUTINE

FIG. 18A

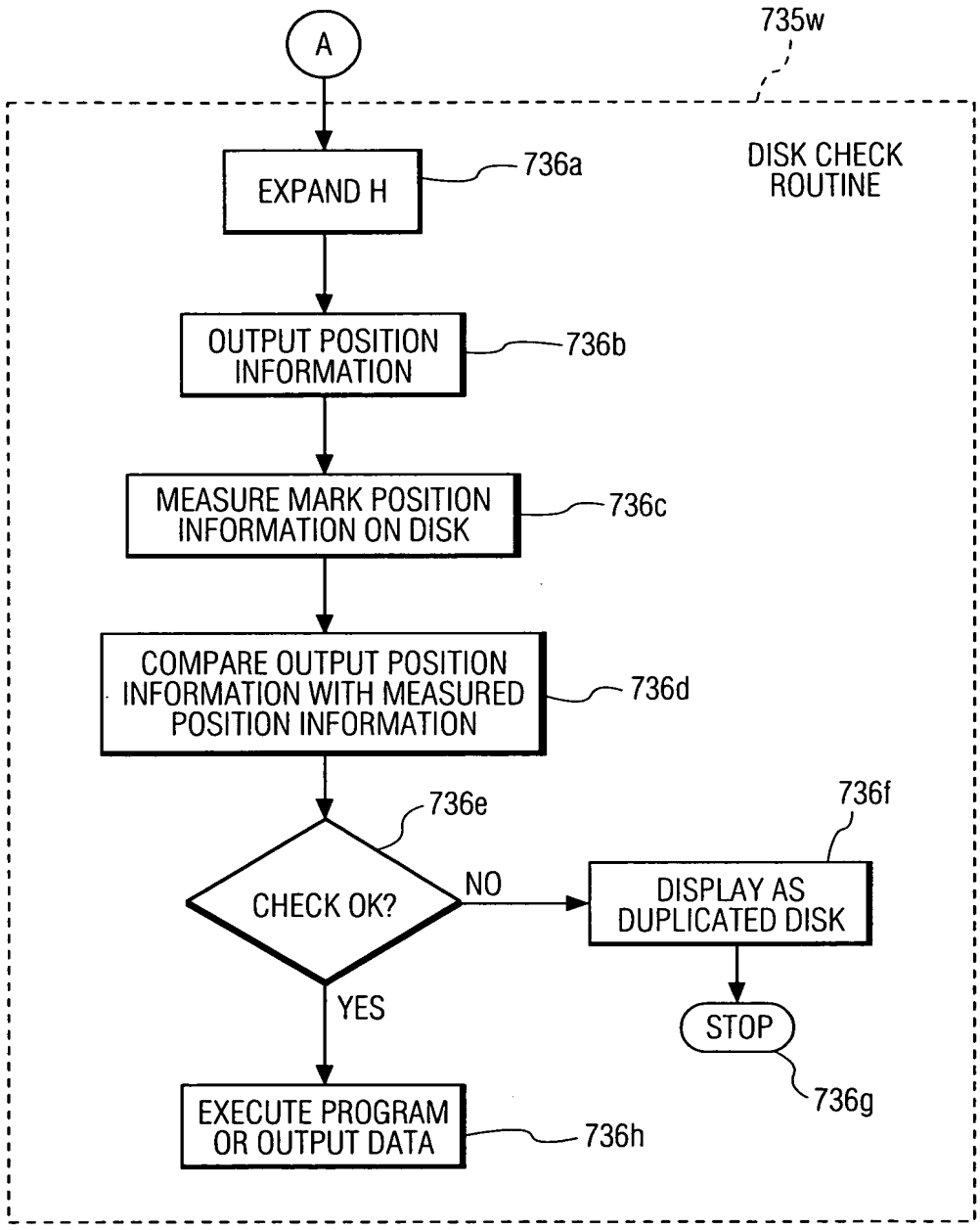

A
735w
DISK CHECK ROUTINE
EXPAND H
736a
OUTPUT POSITION INFORMATION
736b
MEASURE MARK POSITION INFORMATION ON DISK
736c
COMPARE OUTPUT POSITION INFORMATION WITH MEASURED POSITION INFORMATION
736d
736e
CHECK OK?
NO
736f
DISPLAY AS DUPLICATED DISK
YES
STOP
736g
EXECUTE PROGRAM OR OUTPUT DATA
736h

FIG. 18B

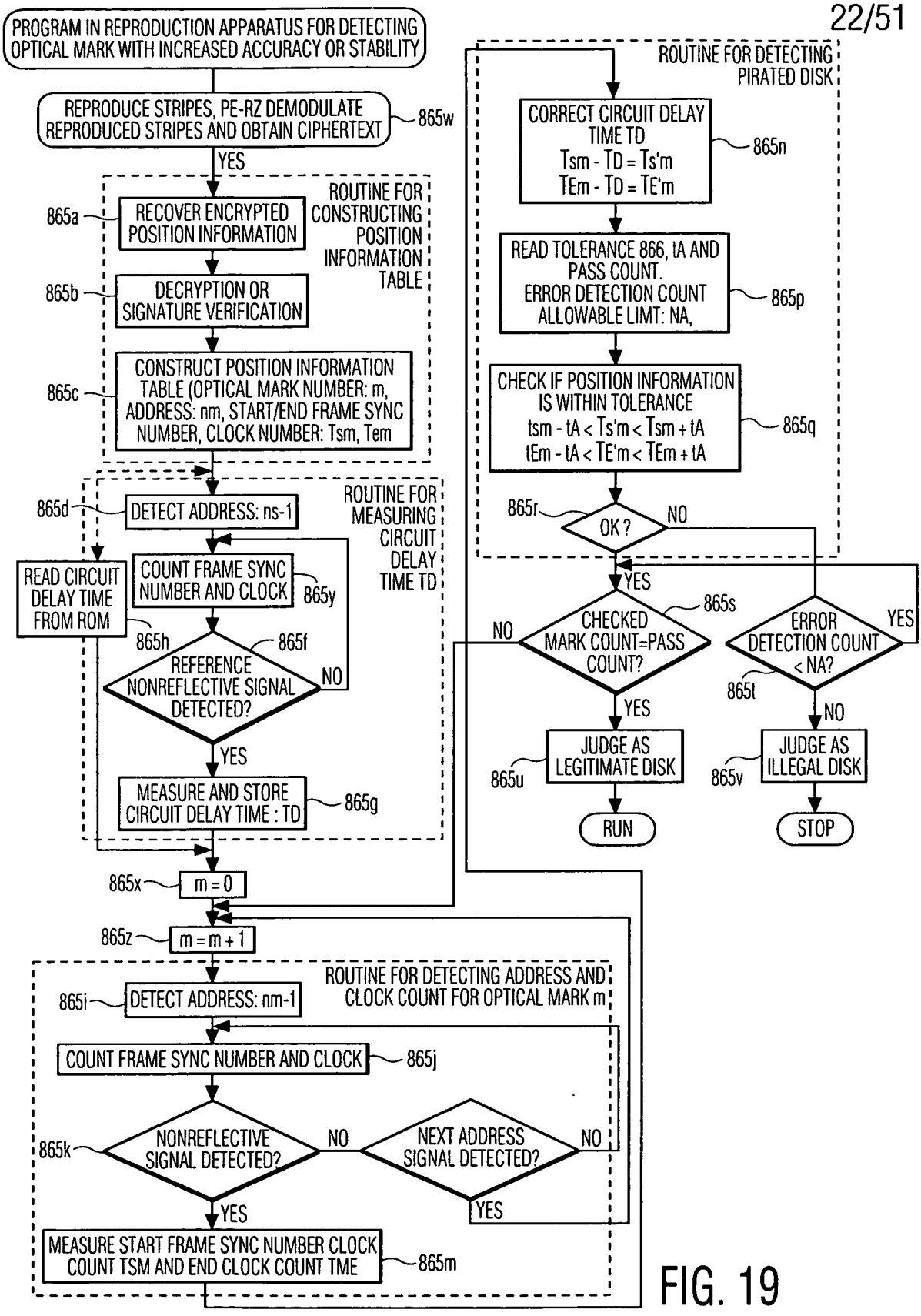

PROGRAM IN REPRODUCTION APPARATUS FOR DETECTING OPTICAL MARK WITH INCREASED ACCURACY OR STABILITY
REPRODUCE STRIPES, PE-RZ DEMODULATE REPRODUCED STRIPES AND OBTAIN CIPHERTEXT
865w
YES
ROUTINE FOR CONSTRUCTING POSITION INFORMATION TABLE
865a
RECOVER ENCRYPTED POSITION INFORMATION
865b
DECRYPTION OR SIGNATURE VERIFICATION
865c
CONSTRUCT POSITION INFORMATION TABLE (OPTICAL MARK NUMBER: m, ADDRESS: nm, START/END FRAME SYNC NUMBER, CLOCK NUMBER: Tsm, Tem
ROUTINE FOR MEASURING CIRCUIT DELAY TIME TD
865d
DETECT ADDRESS: ns-1
COUNT FRAME SYNC NUMBER AND CLOCK
865y
READ CIRCUIT DELAY TIME FROM ROM
865h
865f
REFERENCE NONREFLECTIVE SIGNAL DETECTED?
NO
YES
MEASURE AND STORE CIRCUIT DELAY TIME : TD
865g
865x
m = 0
865z
m = m + 1
ROUTINE FOR DETECTING ADDRESS AND CLOCK COUNT FOR OPTICAL MARK m
865i
DETECT ADDRESS: nm-1
COUNT FRAME SYNC NUMBER AND CLOCK
865j
865k
NONREFLECTIVE SIGNAL DETECTED?
NO
NEXT ADDRESS SIGNAL DETECTED?
NO
YES
YES
MEASURE START FRAME SYNC NUMBER CLOCK COUNT TSM AND END CLOCK COUNT TME
865m
ROUTINE FOR DETECTING PIRATED DISK
CORRECT CIRCUIT DELAY TIME TD
Tsm - TD = Ts'm
TEm - TD = TE'm
865n
READ TOLERANCE 866, tA AND PASS COUNT. ERROR DETECTION COUNT ALLOWABLE LIMT: NA,
865p
CHECK IF POSITION INFORMATION IS WITHIN TOLERANCE
tsm - tA < Ts'm < Tsm + tA
tEm - tA < TE'm < TEm + tA
865q
865r
OK ?
NO
YES
865s
CHECKED MARK COUNT=PASS COUNT?
NO
YES
ERROR DETECTION COUNT < NA?
YES
865t
NO
JUDGE AS LEGITIMATE DISK
865u
JUDGE AS ILLEGAL DISK
865v
RUN
STOP

FIG. 19

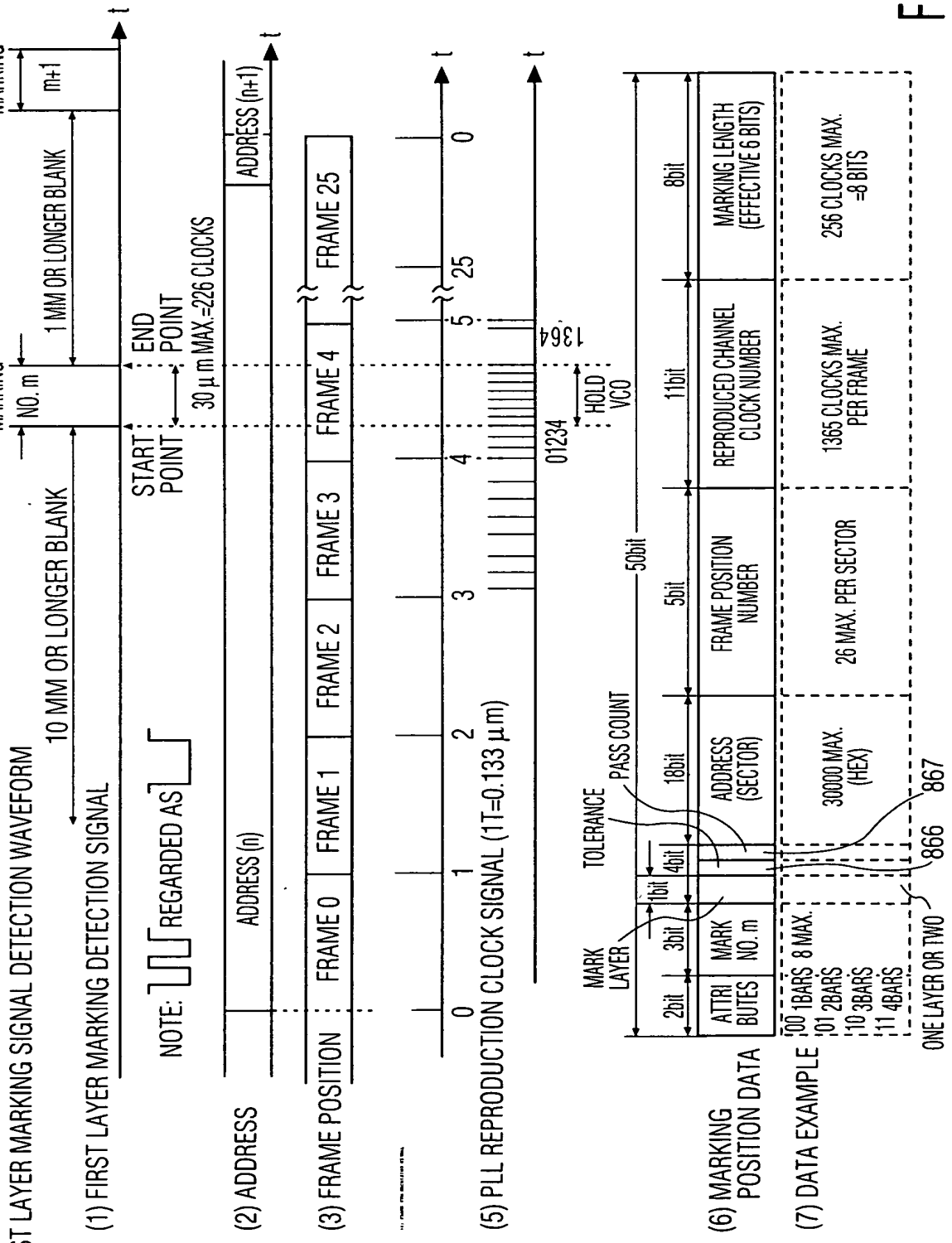

FIRST LAYER MARKING SIGNAL DETECTION WAVEFORM
(1) FIRST LAYER MARKING DETECTION SIGNAL
10 MM OR LONGER BLANK
MARKING NO. m
1 MM OR LONGER BLANK
NEXT MARKING
m+1
NOTE: REGARDED AS
START POINT
END POINT
30 μm MAX.=226 CLOCKS
(2) ADDRESS
ADDRESS (n)
ADDRESS (n+1)
(3) FRAME POSITION
FRAME 0
FRAME 1
FRAME 2
FRAME 3
FRAME 4
FRAME 25
(5) PLL REPRODUCTION CLOCK SIGNAL (1T=0.133 μm)
0 1 2 3 4 5 25
01234
1364
HOLD VCO
(6) MARKING POSITION DATA
MARK LAYER
TOLERANCE
PASS COUNT
50bit
2bit
3bit
1bit
4bit
18bit
5bit
11bit
8bit
ATTRIBUTES
MARK NO. m
ADDRESS (SECTOR)
FRAME POSITION NUMBER
REPRODUCED CHANNEL CLOCK NUMBER
MARKING LENGTH (EFFECTIVE 6 BITS)
(7) DATA EXAMPLE
00 1BARS
01 2BARS
10 3BARS
11 4BARS
8 MAX.
30000 MAX. (HEX)
26 MAX. PER SECTOR
1365 CLOCKS MAX. PER FRAME
256 CLOCKS MAX. =8 BITS
ONE LAYER OR TWO
866
867

FIG. 20

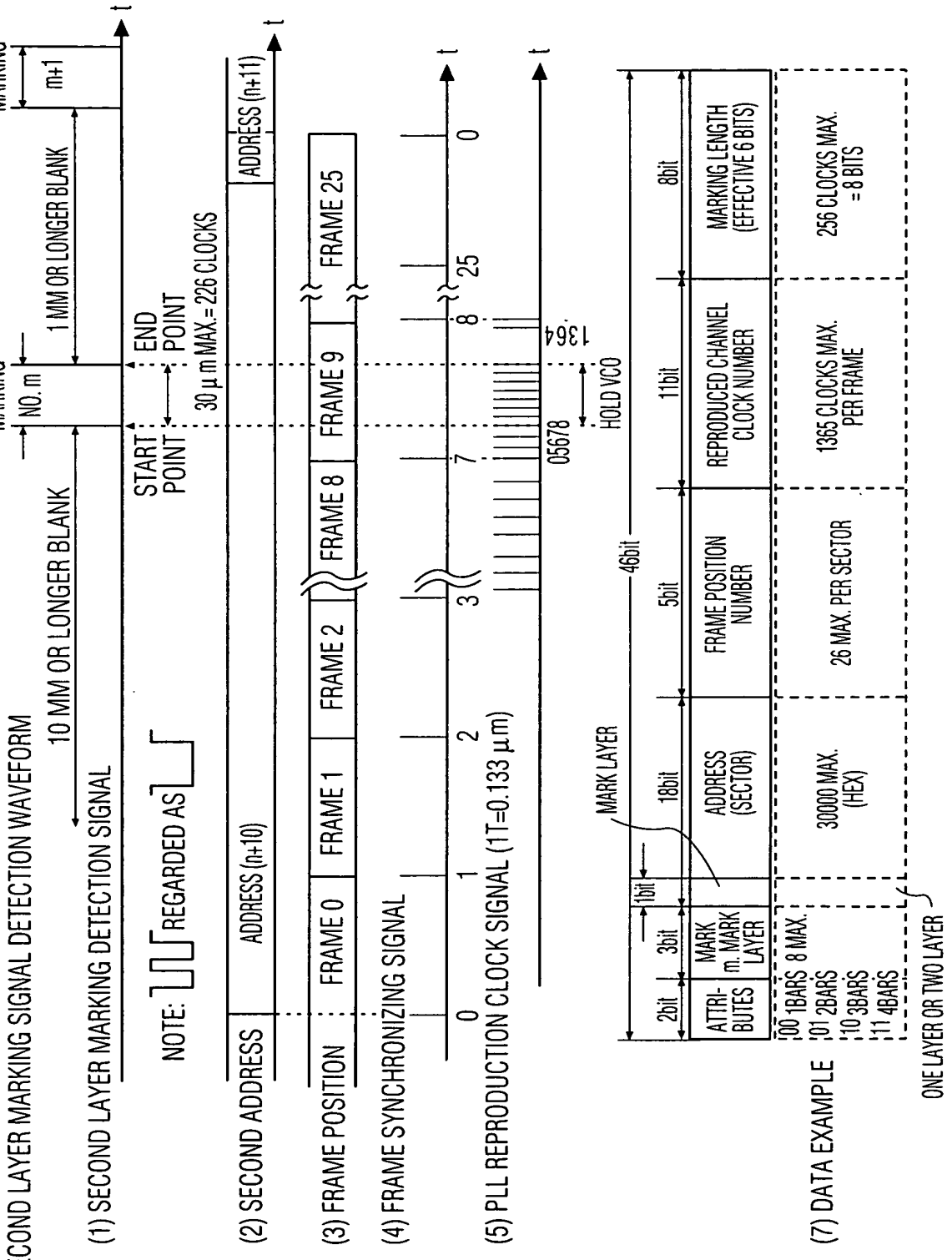

SECOND LAYER MARKING SIGNAL DETECTION WAVEFORM
(1) SECOND LAYER MARKING DETECTION SIGNAL
10 MM OR LONGER BLANK
MARKING NO. m
1 MM OR LONGER BLANK
NEXT MARKING m+1
NOTE: REGARDED AS
START POINT
END POINT
30 μ m MAX.= 226 CLOCKS
(2) SECOND ADDRESS
ADDRESS (n+10)
ADDRESS (n+11)
(3) FRAME POSITION
FRAME 0
FRAME 1
FRAME 2
FRAME 8
FRAME 9
FRAME 25
(4) FRAME SYNCHRONIZING SIGNAL
(5) PLL REPRODUCTION CLOCK SIGNAL (1T=0.133 μm)
0
1
2
3
7
8
25
05678
1364
HOLD VCO
MARK LAYER
46bit
2bit
3bit
1bit
18bit
5bit
11bit
8bit
ATTRI-BUTES
MARK m. MARK LAYER
ADDRESS (SECTOR)
FRAME POSITION NUMBER
REPRODUCED CHANNEL CLOCK NUMBER
MARKING LENGTH (EFFECTIVE 6 BITS)
00 1BARS 8 MAX.
01 2BARS
10 3BARS
11 4BARS
30000 MAX. (HEX)
26 MAX. PER SECTOR
1365 CLOCKS MAX. PER FRAME
256 CLOCKS MAX. = 8 BITS
(7) DATA EXAMPLE
ONE LAYER OR TWO LAYER

FIG. 21

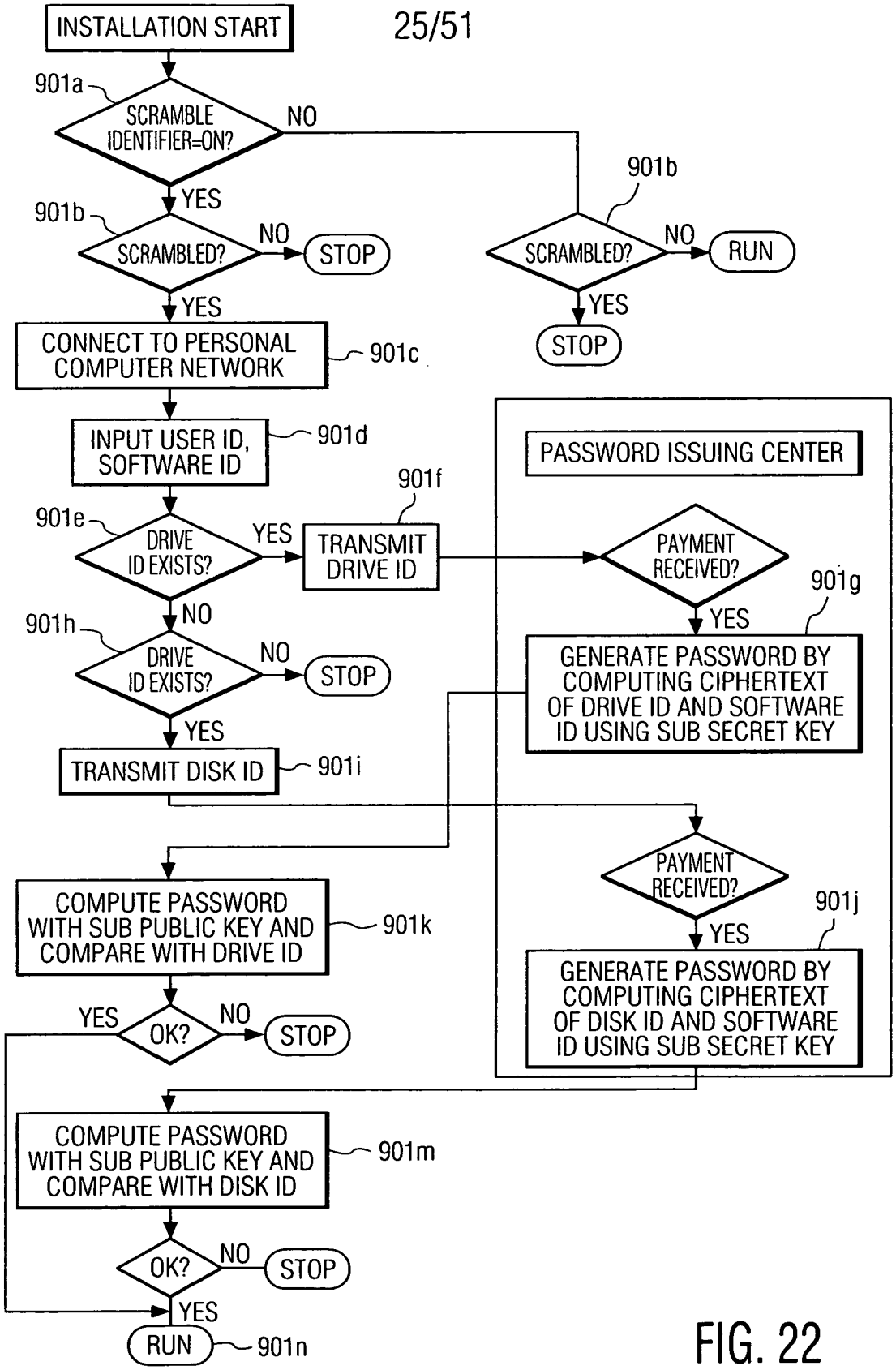

INSTALLATION START
901a
SCRAMBLE IDENTIFIER=ON?
NO
YES
901b
SCRAMBLED?
NO
STOP
YES
CONNECT TO PERSONAL COMPUTER NETWORK
901c
INPUT USER ID, SOFTWARE ID
901d
901e
DRIVE ID EXISTS?
YES
901f
TRANSMIT DRIVE ID
NO
901h
DRIVE ID EXISTS?
NO
STOP
YES
TRANSMIT DISK ID
901i
COMPUTE PASSWORD WITH SUB PUBLIC KEY AND COMPARE WITH DRIVE ID
901k
YES
OK?
NO
STOP
COMPUTE PASSWORD WITH SUB PUBLIC KEY AND COMPARE WITH DISK ID
901m
OK?
NO
STOP
YES
RUN
901n
901b
SCRAMBLED?
NO
RUN
YES
STOP
PASSWORD ISSUING CENTER
PAYMENT RECEIVED?
YES
901g
GENERATE PASSWORD BY COMPUTING CIPHERTEXT OF DRIVE ID AND SOFTWARE ID USING SUB SECRET KEY
PAYMENT RECEIVED?
YES
901j
GENERATE PASSWORD BY COMPUTING CIPHERTEXT OF DISK ID AND SOFTWARE ID USING SUB SECRET KEY

FIG. 22

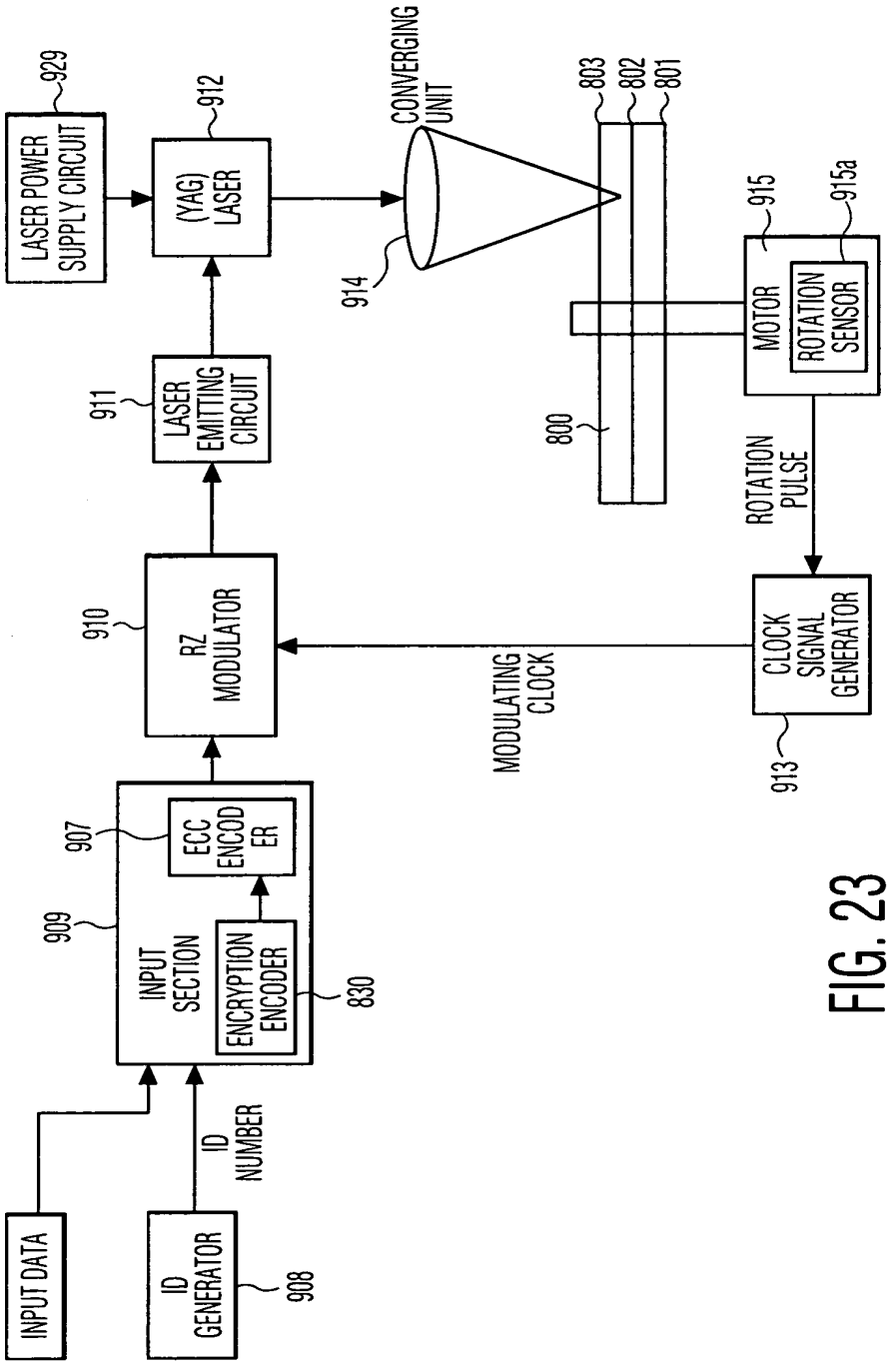

INPUT DATA
ID GENERATOR
908
ID NUMBER
INPUT SECTION
909
ECC ENCODER
907
ENCRYPTION ENCODER
830
RZ MODULATOR
910
LASER EMITTING CIRCUIT
911
(YAG) LASER
912
LASER POWER SUPPLY CIRCUIT
929
CONVERGING UNIT
914
803
802
801
800
MOTOR
915
ROTATION SENSOR
915a
ROTATION PULSE
CLOCK SIGNAL GENERATOR
913
MODULATING CLOCK

FIG. 23

FIG. 24A

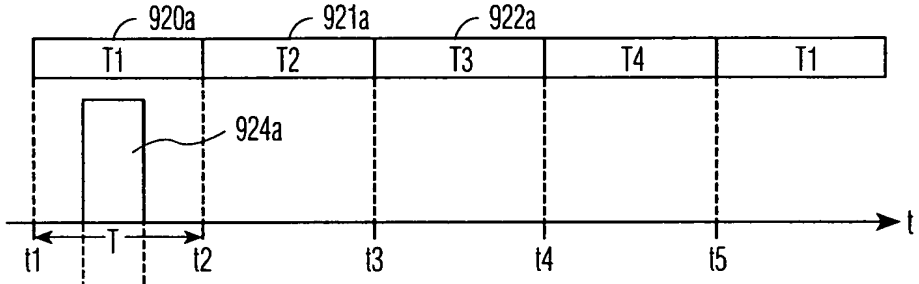


FIG. 24B

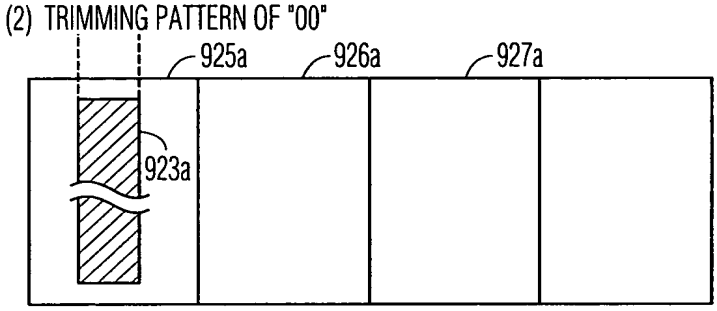


FIG. 24C

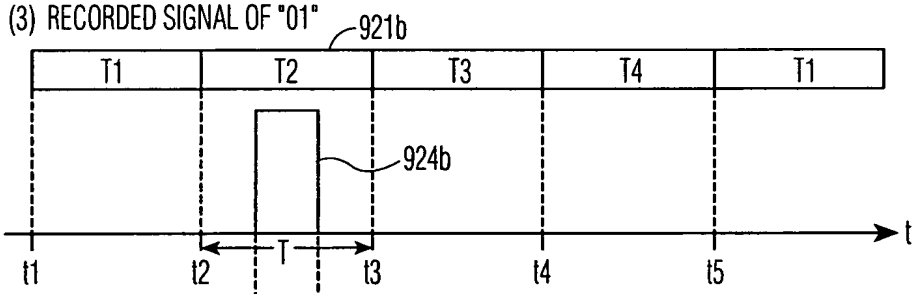


FIG. 24D

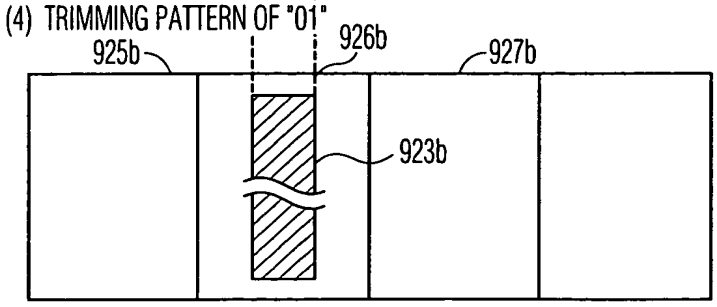


FIG. 24E

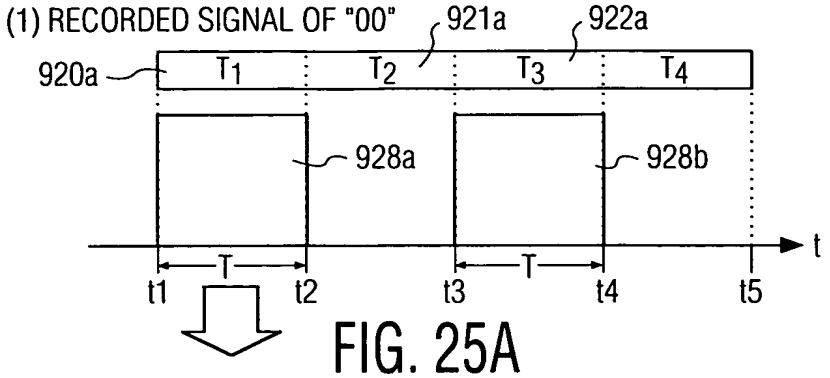


FIG. 25A

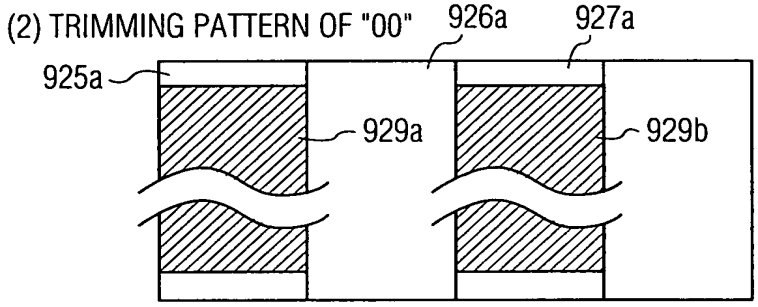


FIG. 25B

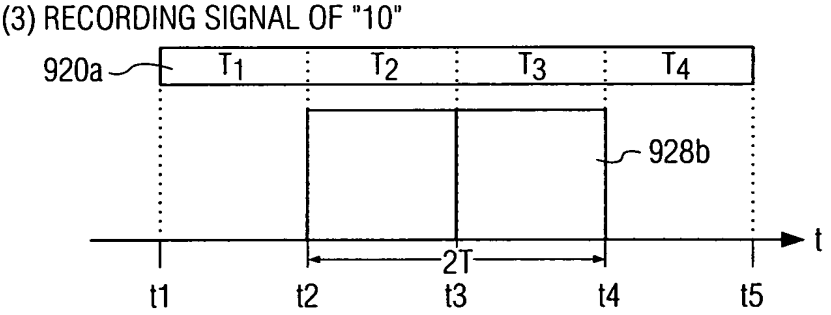


FIG. 25C

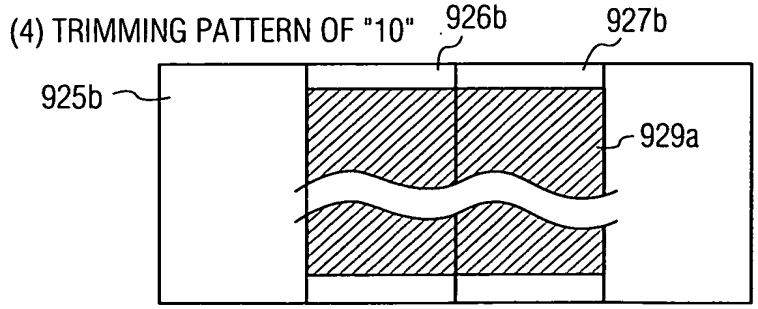


FIG. 25D

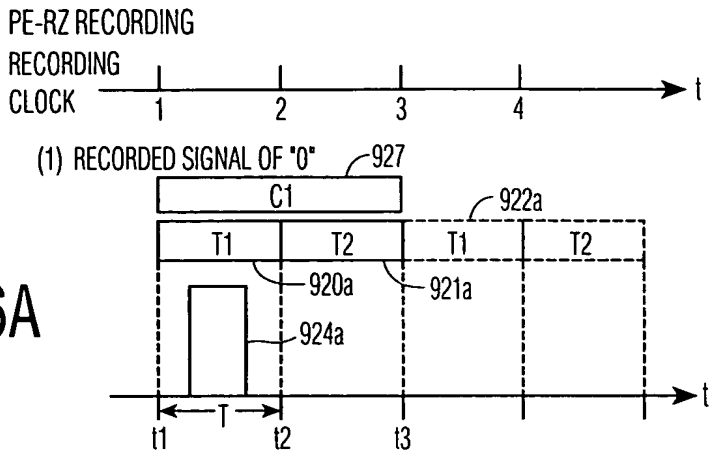


FIG. 26A

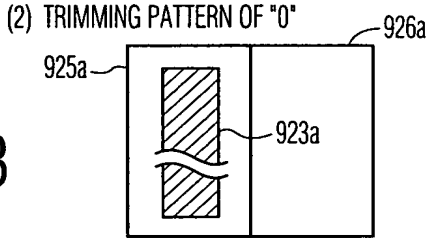


FIG. 26B

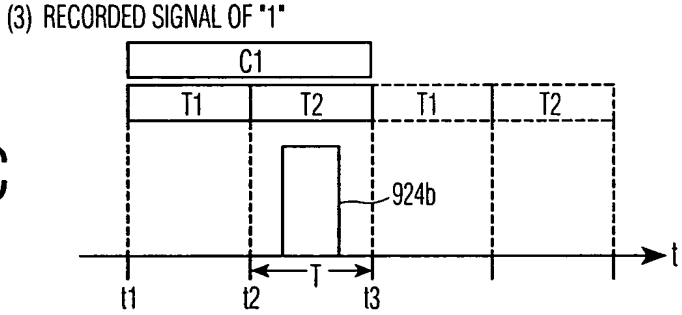


FIG. 26C

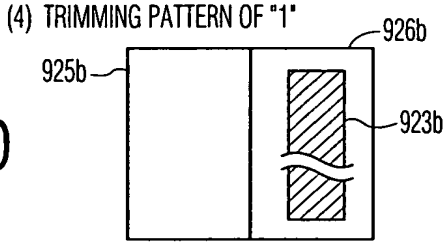


FIG. 26D

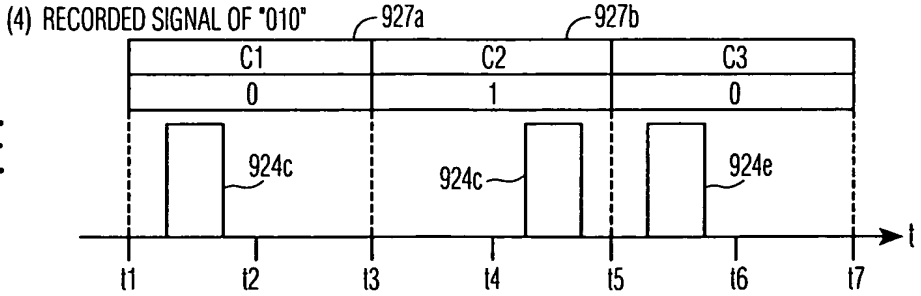


FIG. 26E

(1) TOP PLAN VIEW

FIG. 27A

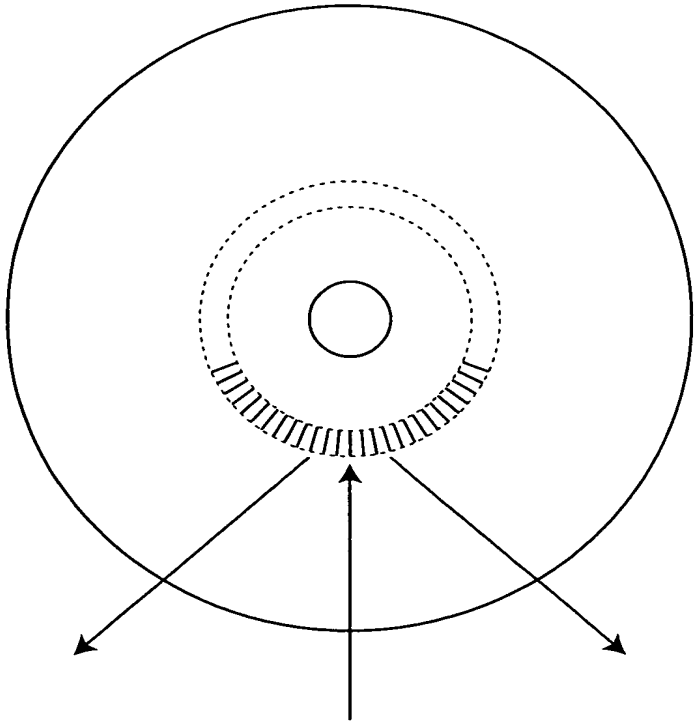


FIG. 27B

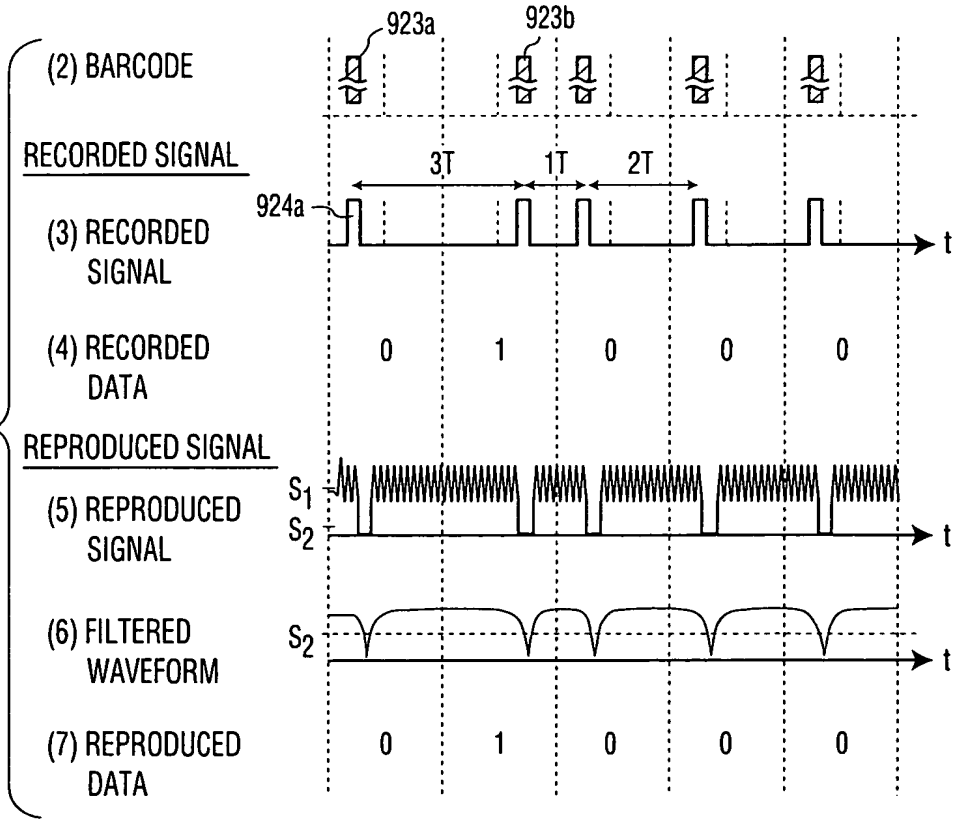


FIG. 28A

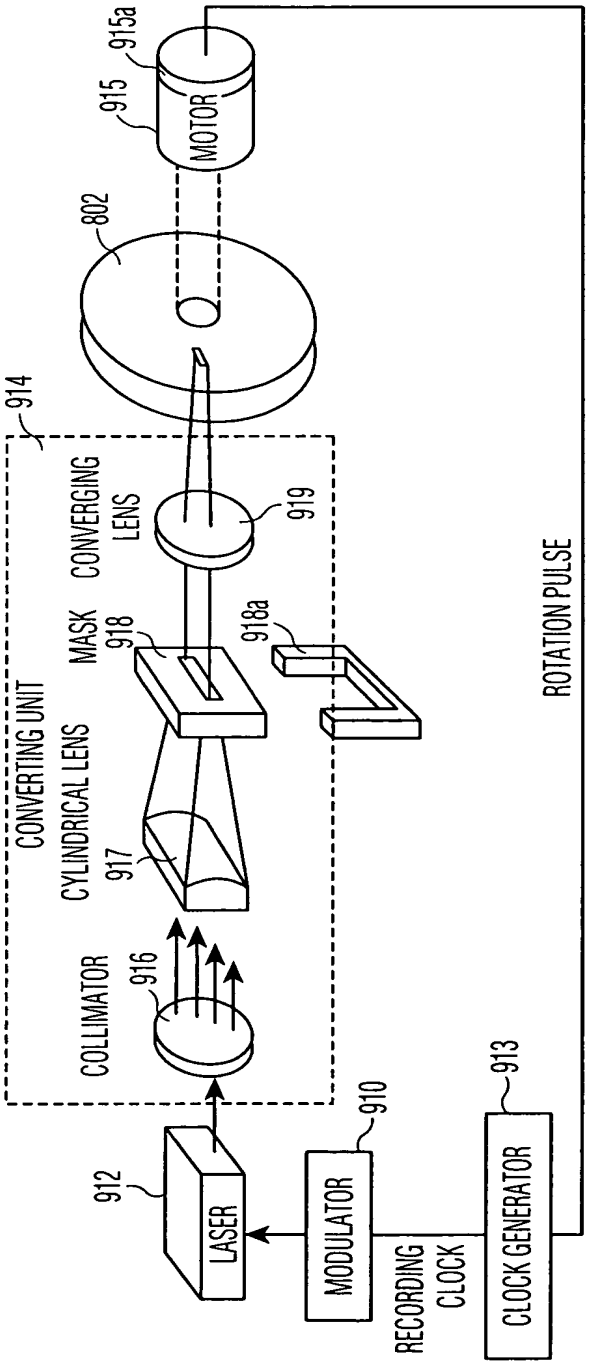


FIG. 28B

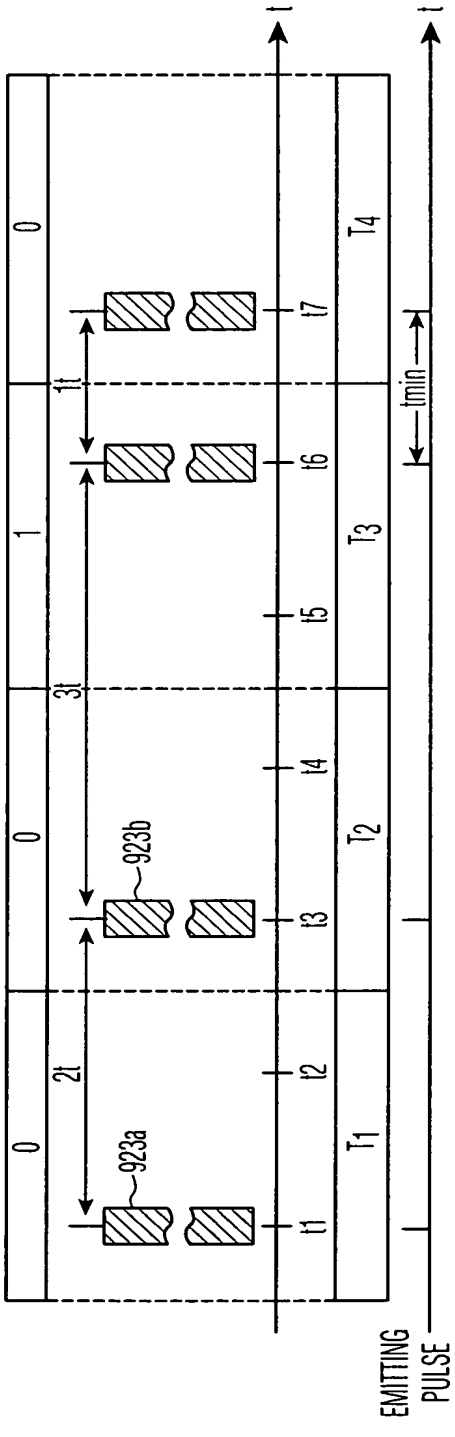


FIG. 29A

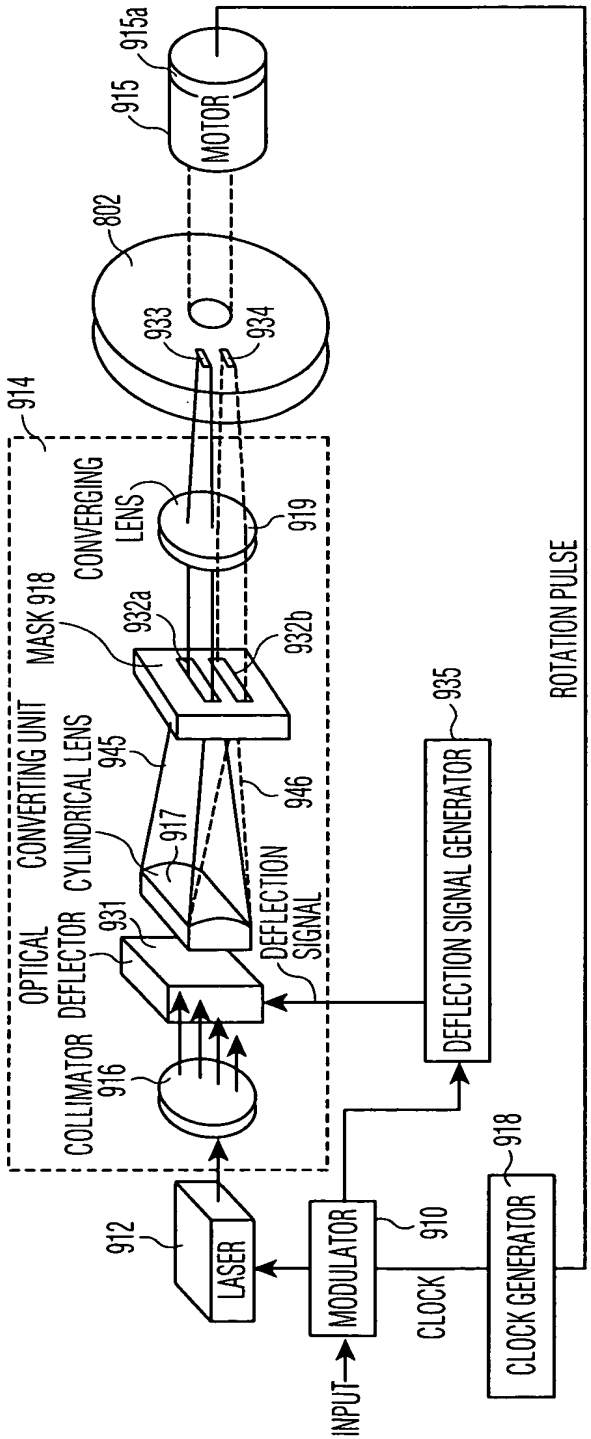
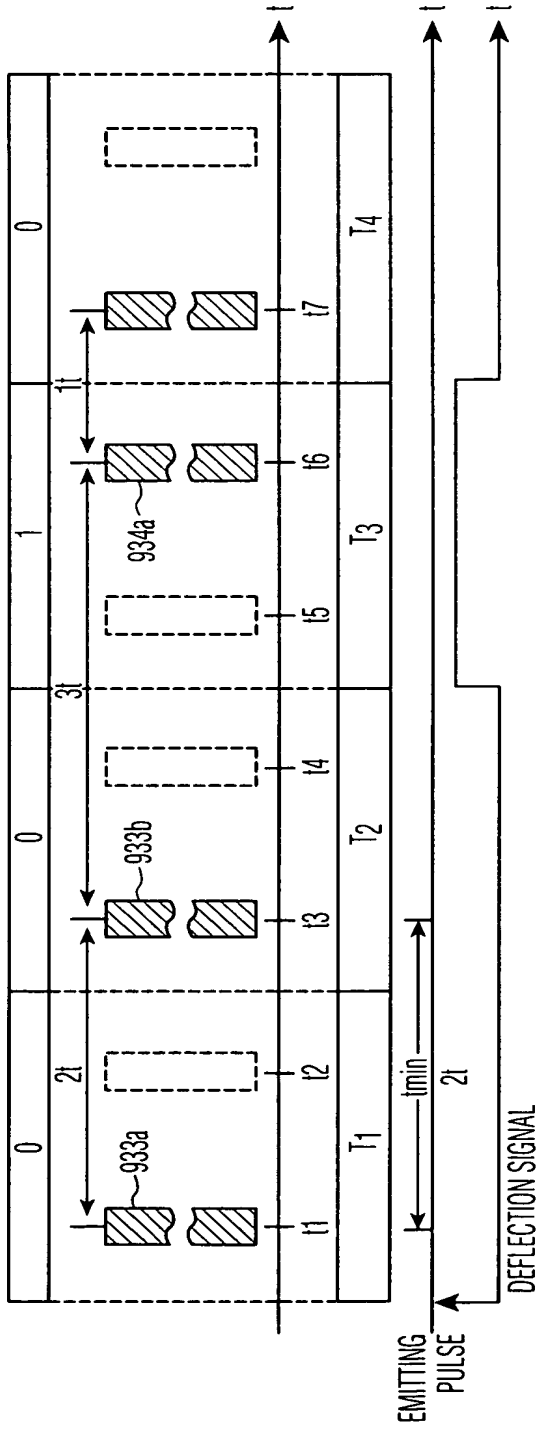


FIG. 29B



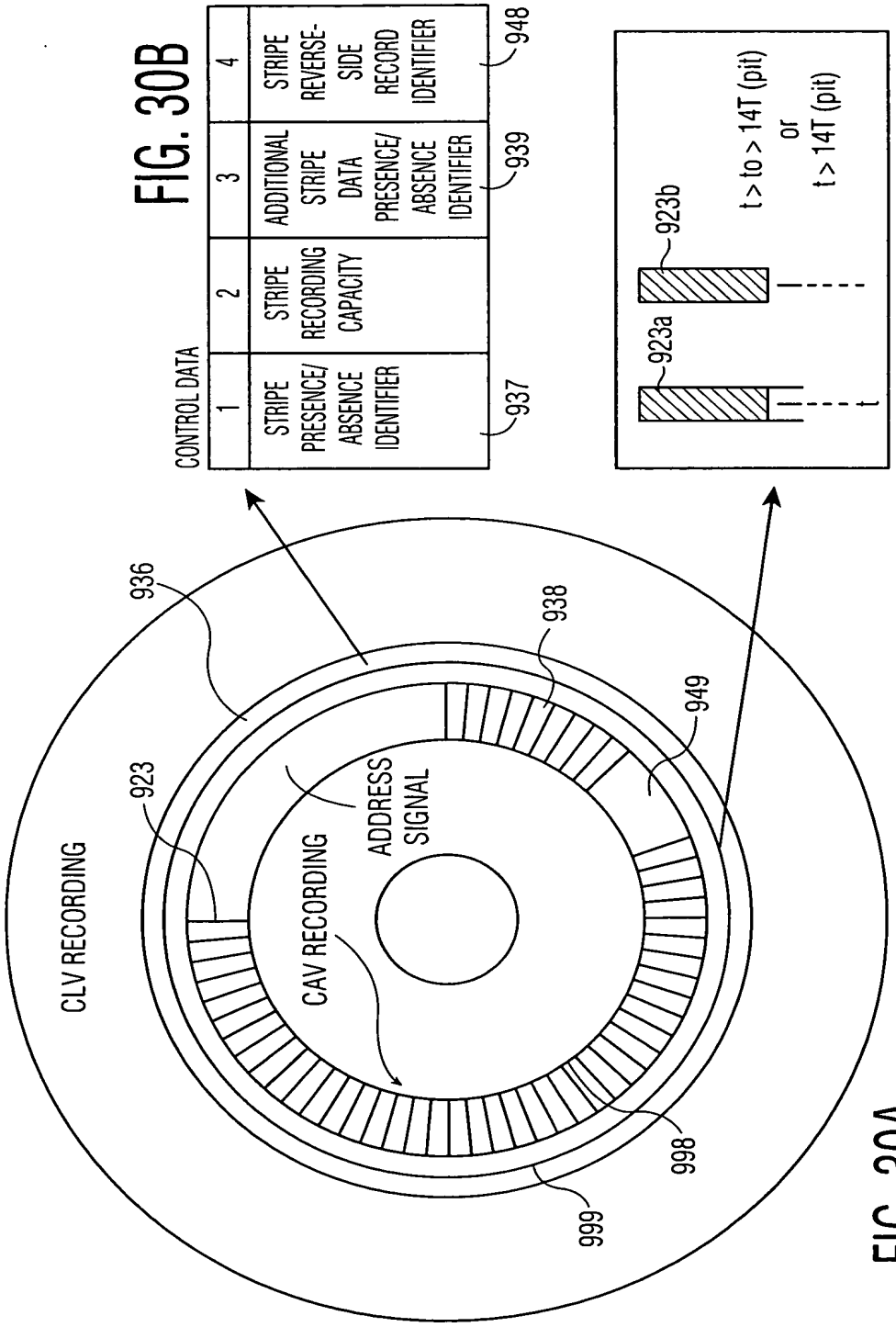


FIG. 30A

CONTROL DATA

1	2	3	4
STRIPE PRESENCE/ ABSENCE IDENTIFIER	STRIPE RECORDING CAPACITY	ADDITIONAL STRIPE DATA PRESENCE/ ABSENCE IDENTIFIER	STRIPE REVERSE-SIDE RECORD IDENTIFIER
937		939	948

FIG. 30B

FIG. 30C

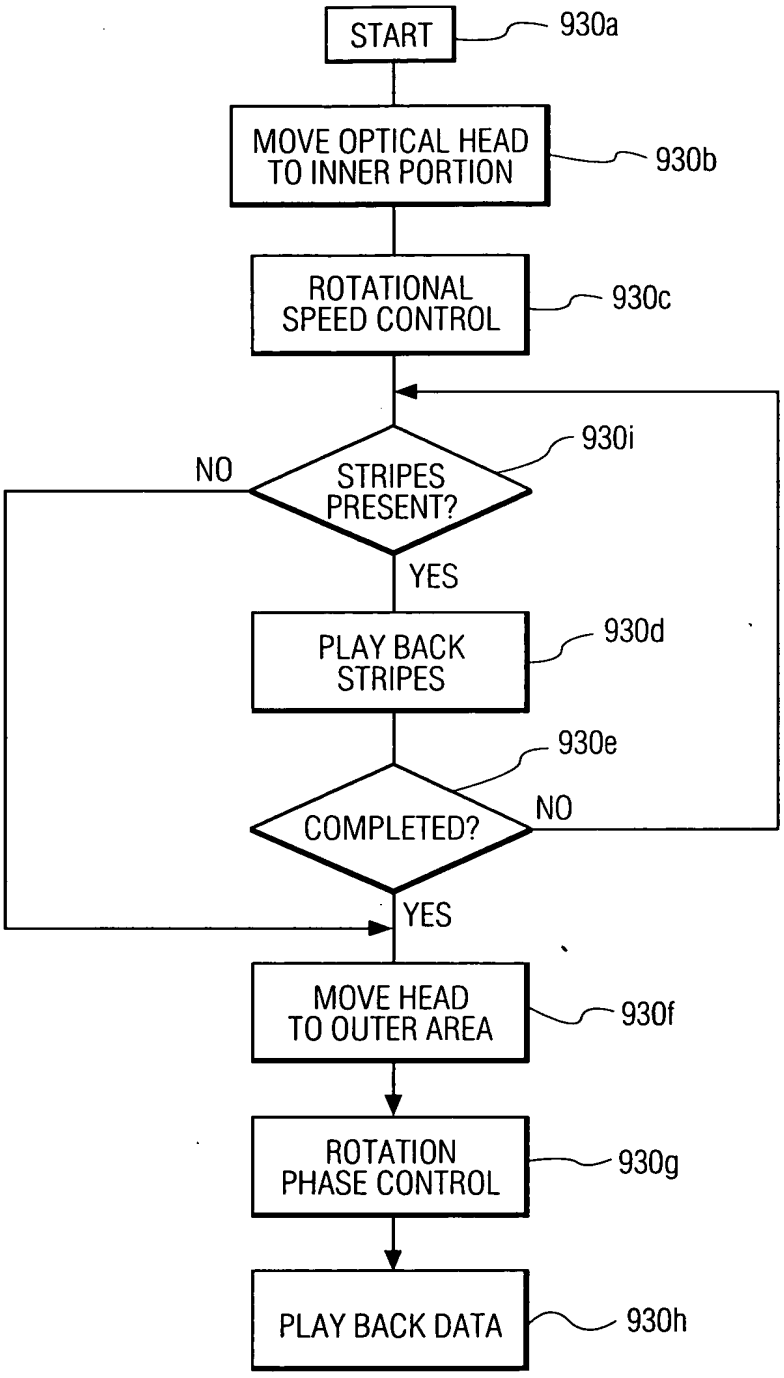

START
930a
MOVE OPTICAL HEAD TO INNER PORTION
930b
ROTATIONAL SPEED CONTROL
930c
930i
NO
STRIPES PRESENT?
YES
PLAY BACK STRIPES
930d
930e
COMPLETED?
NO
YES
MOVE HEAD TO OUTER AREA
930f
ROTATION PHASE CONTROL
930g
PLAY BACK DATA
930h

FIG. 31

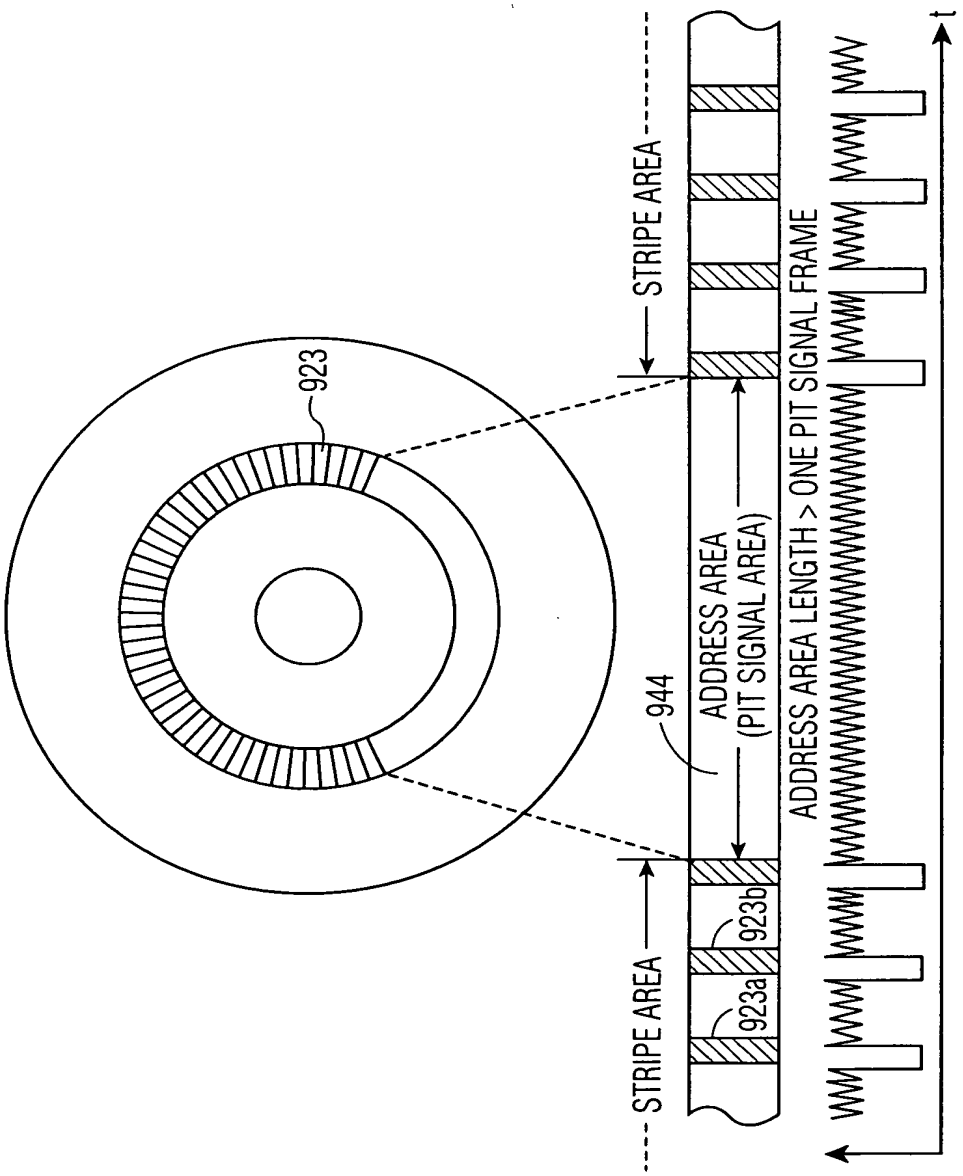

923
STRIPE AREA
944
ADDRESS AREA
(PIT SIGNAL AREA)
ADDRESS AREA LENGTH > ONE PIT SIGNAL FRAME
923b
923a
STRIPE AREA
t

FIG. 32

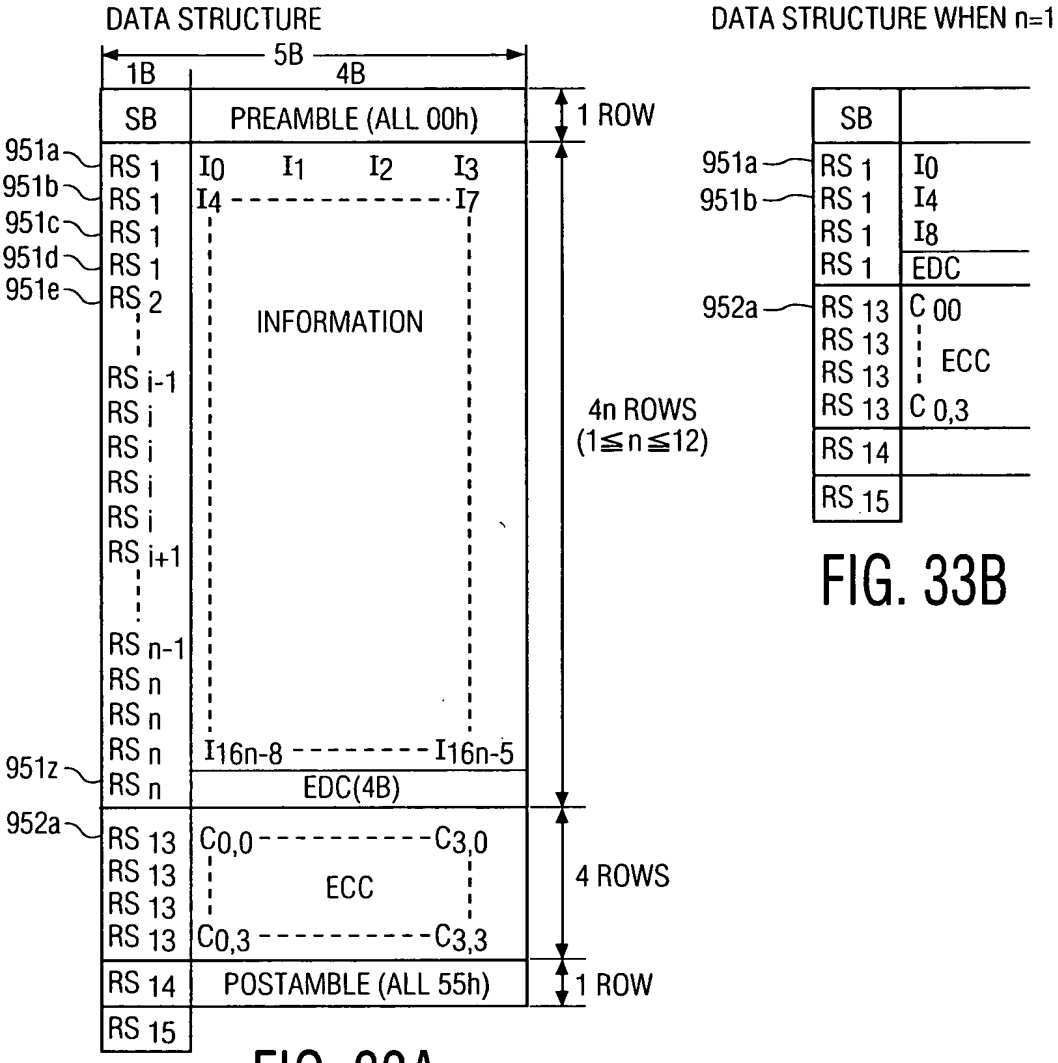


FIG. 33B

FIG. 33A

RANDOM ERROR CORRECTION CAPABILITY

BIT ERROR RATE BEFORE CORRECTION	READ ERROR RATE AFTER CORRECTION
10^{-5}	1 IN 10^{10} DISKS
10^{-4}	1 IN 10^{7} DISKS
10^{-3}	1 IN 10^{4} DISKS
BURST ERROR CORRECTION CAPABILITY	

FIG. 33C

SYNCHRONIZATION CODE DATA

SYNCHRONIZATION CODE

SYNC BYTE /RESYNC	BIT PATTERN											
	FIXED PATTERN (CHANNEL BIT)								SYNC CODE (DATA BIT)			
	C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8	b_3	b_2	b_1	b_0
SB	0	1	0	0	0	1	1	0	0	0	0	0
RS_1	0	1	0	0	0	1	1	0	0	0	0	1
RS_2	0	1	0	0	0	1	1	0	0	0	1	0
⋮												
RS_i	0	1	0	0	0	1	1	0			i	
⋮												
RS_{15}	0	1	0	0	0	1	1	0	1	1	1	1

FIG. 34A

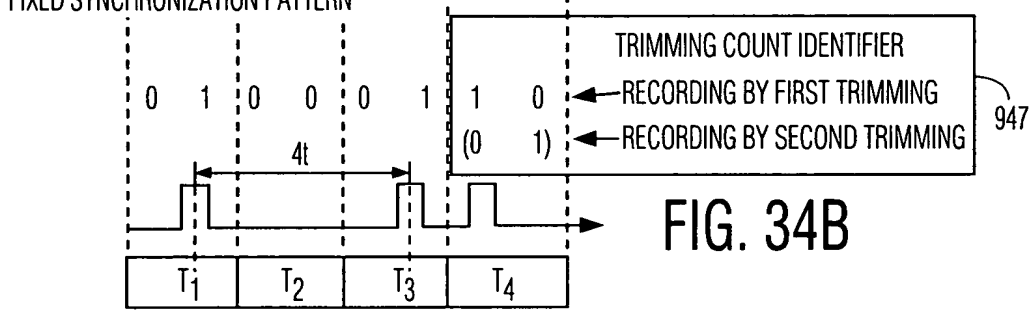


FIG. 34B

MAXIMUM CAPACITY

	RECORDING CAPACITY	TOTAL BYTE COUNT	EFFICIENCY	RECORDING AREA ANGLE	UNRECORDED AREA ANGLE
MINIMUM	12B	41B	29.3%	51 DEGREES	309 DEGREES
MAXIMUM	188B	271B	69.4%	336 DEGREES	24 DEGREES

FIG. 34C

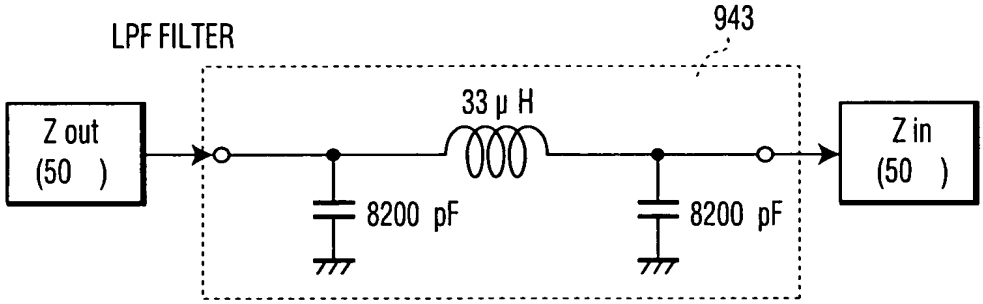


FIG. 35A

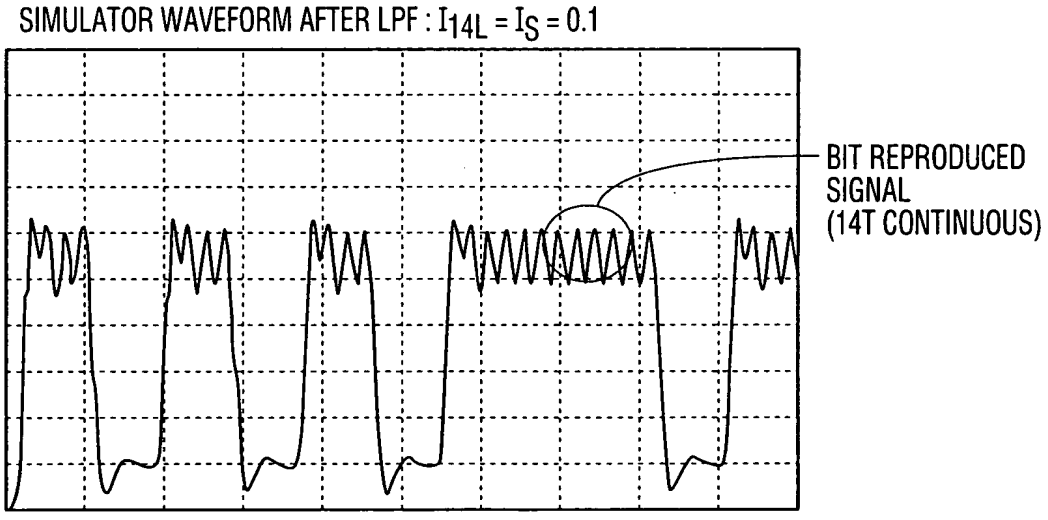


FIG. 35B

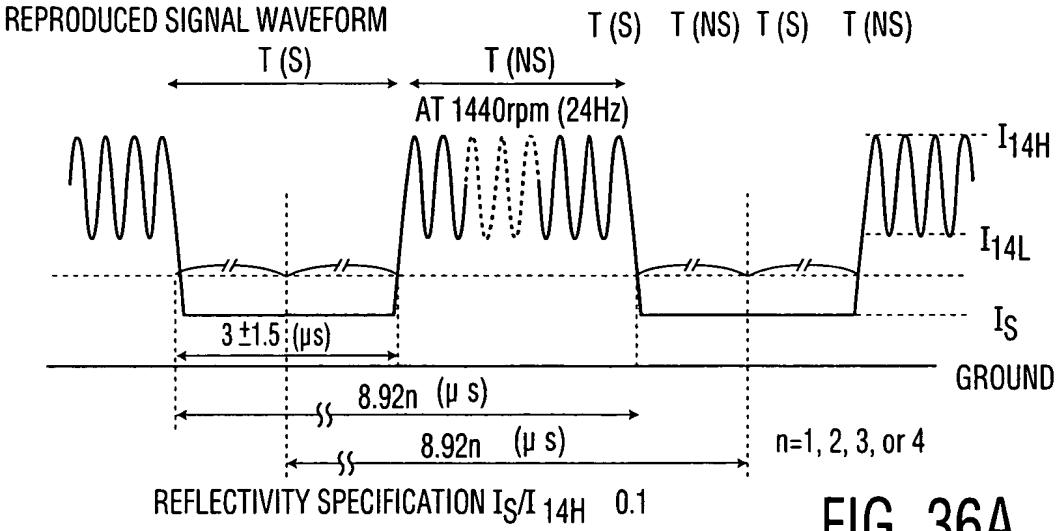


FIG. 36A

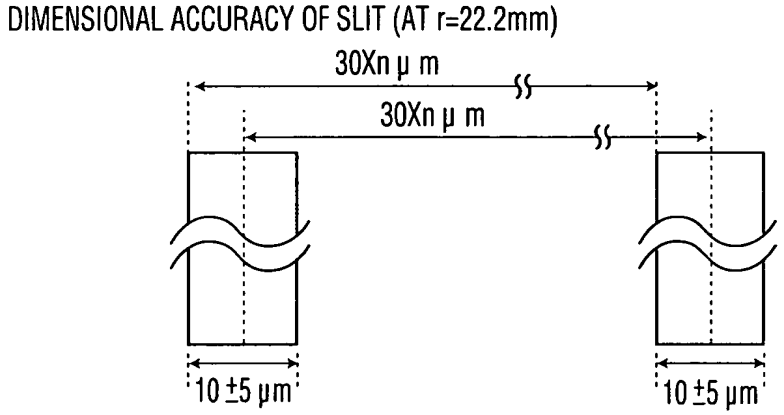


FIG. 36B

FIG. 36C

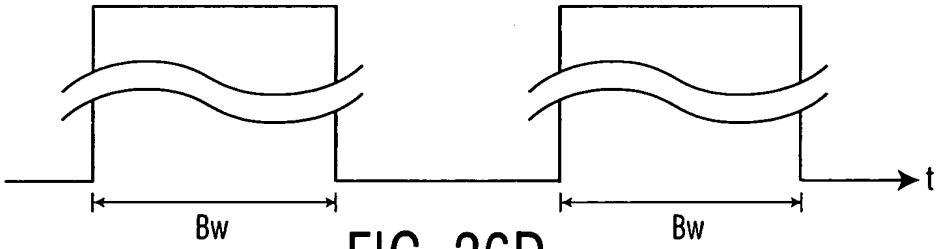


FIG. 36D

(1) TIME SLOT

FIG. 37A

(2) CHANNEL BIT

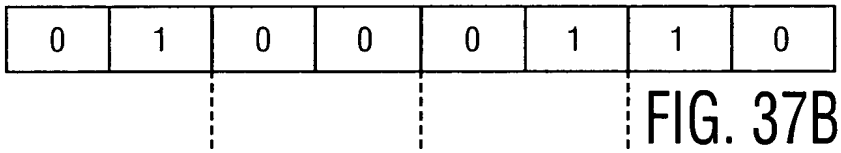


FIG. 37B

(3) RECORDING PULSE

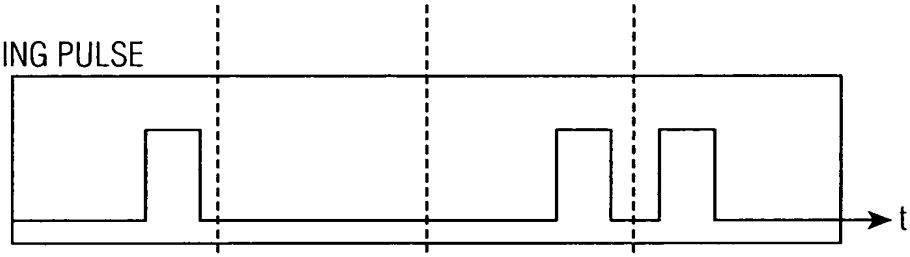


FIG. 37C

(4) EMITTING PULSE

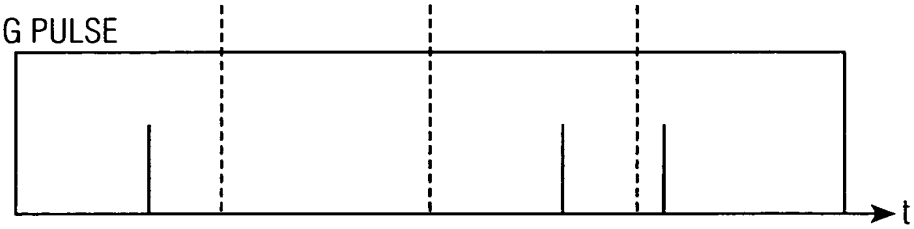


FIG. 37D

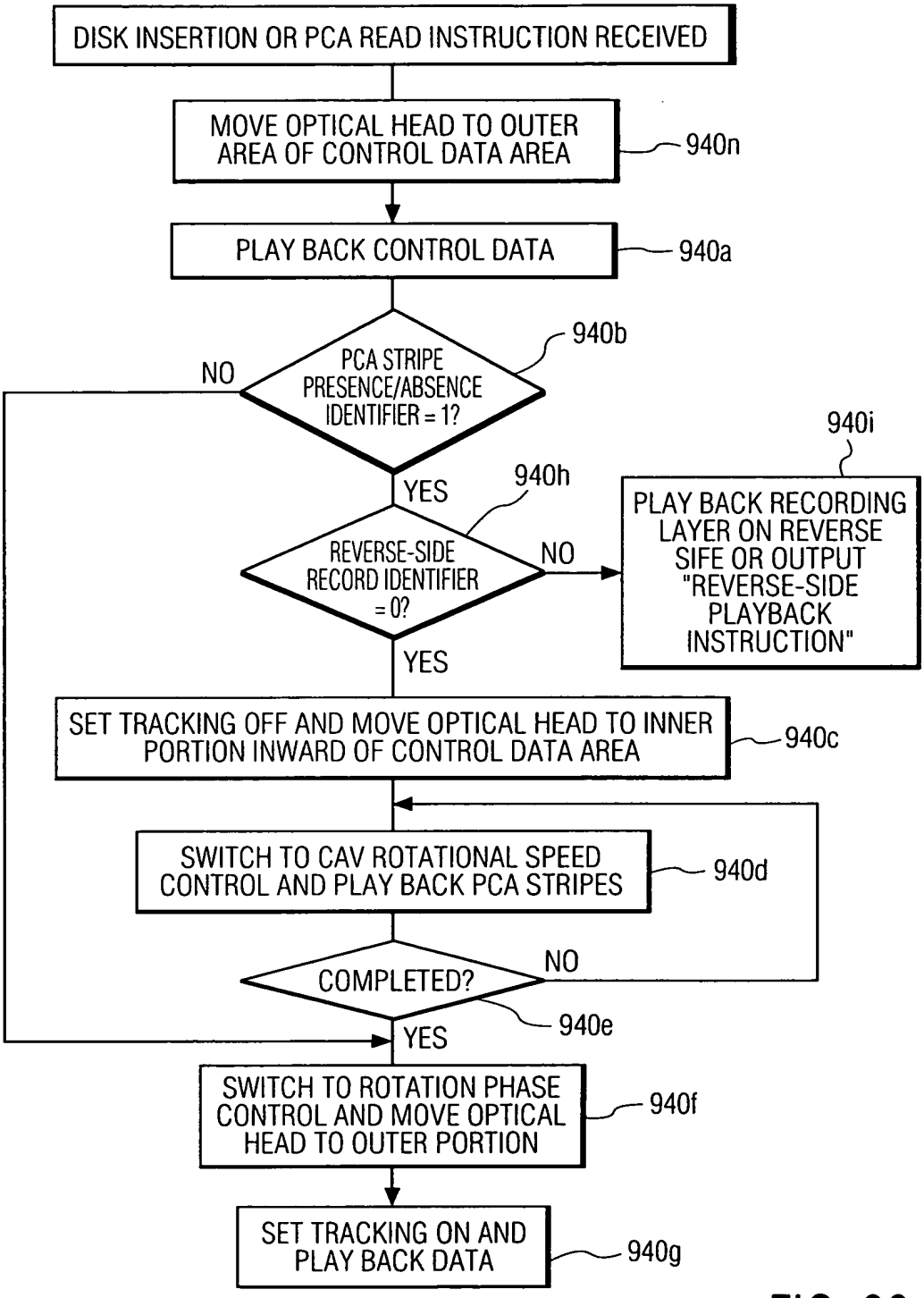

DISK INSERTION OR PCA READ INSTRUCTION RECEIVED
MOVE OPTICAL HEAD TO OUTER AREA OF CONTROL DATA AREA
940n
PLAY BACK CONTROL DATA
940a
PCA STRIPE PRESENCE/ABSENCE IDENTIFIER = 1?
940b
NO
YES
REVERSE-SIDE RECORD IDENTIFIER = 0?
940h
NO
PLAY BACK RECORDING LAYER ON REVERSE SIFE OR OUTPUT "REVERSE-SIDE PLAYBACK INSTRUCTION"
940i
YES
SET TRACKING OFF AND MOVE OPTICAL HEAD TO INNER PORTION INWARD OF CONTROL DATA AREA
940c
SWITCH TO CAV ROTATIONAL SPEED CONTROL AND PLAY BACK PCA STRIPES
940d
COMPLETED?
NO
940e
YES
SWITCH TO ROTATION PHASE CONTROL AND MOVE OPTICAL HEAD TO OUTER PORTION
940f
SET TRACKING ON AND PLAY BACK DATA
940g

FIG. 38

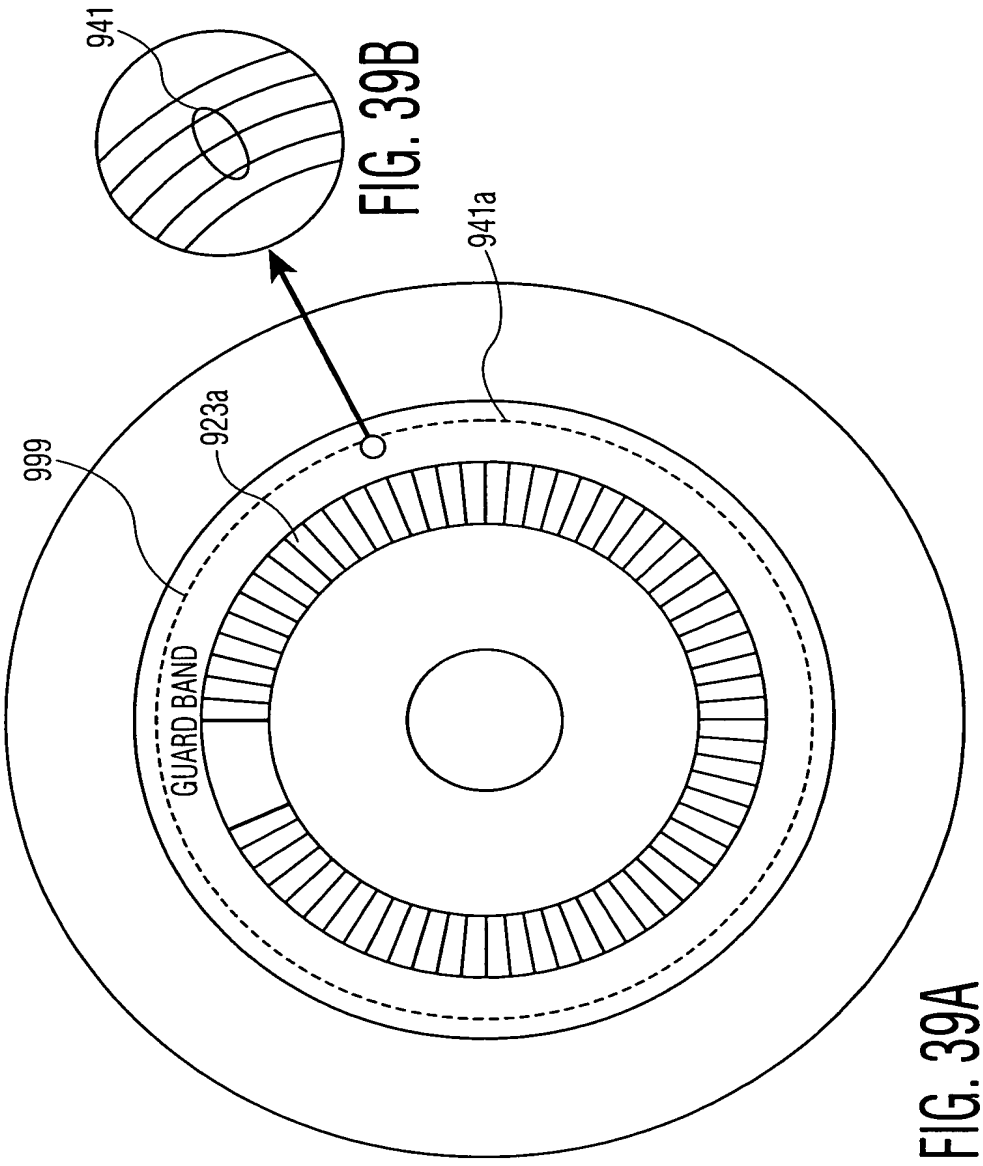


FIG. 39B

FIG. 39A

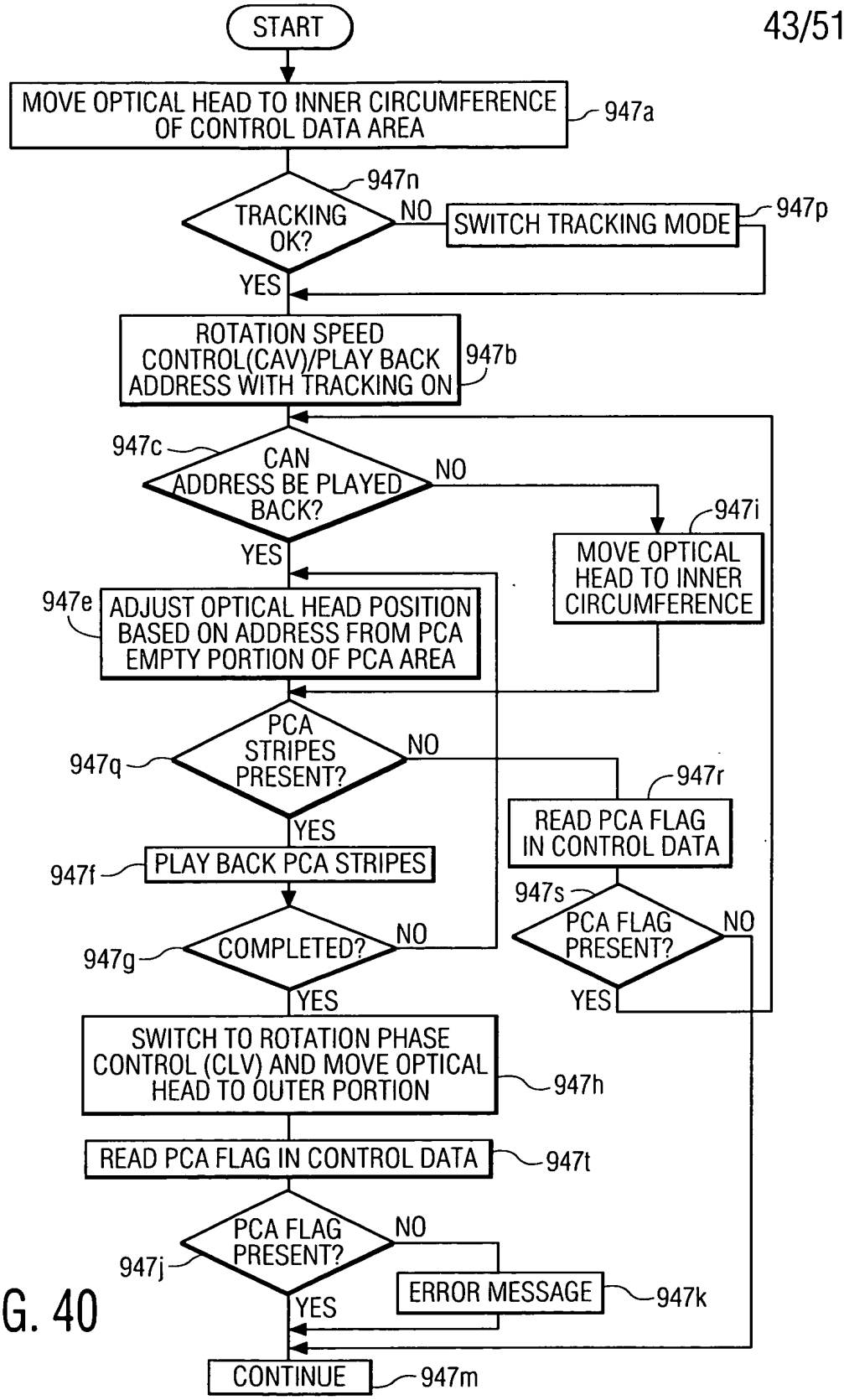

START
MOVE OPTICAL HEAD TO INNER CIRCUMFERENCE OF CONTROL DATA AREA
947a
947n
TRACKING OK?
NO
SWITCH TRACKING MODE
947p
YES
ROTATION SPEED CONTROL(CAV)/PLAY BACK ADDRESS WITH TRACKING ON
947b
947c
CAN ADDRESS BE PLAYED BACK?
NO
947i
MOVE OPTICAL HEAD TO INNER CIRCUMFERENCE
YES
947e
ADJUST OPTICAL HEAD POSITION BASED ON ADDRESS FROM PCA EMPTY PORTION OF PCA AREA
PCA STRIPES PRESENT?
947q
NO
947r
READ PCA FLAG IN CONTROL DATA
YES
947f
PLAY BACK PCA STRIPES
947s
PCA FLAG PRESENT?
NO
947g
COMPLETED?
NO
YES
YES
SWITCH TO ROTATION PHASE CONTROL (CLV) AND MOVE OPTICAL HEAD TO OUTER PORTION
947h
READ PCA FLAG IN CONTROL DATA
947t
PCA FLAG PRESENT?
NO
947j
ERROR MESSAGE
947k
YES
CONTINUE
947m

FIG. 40

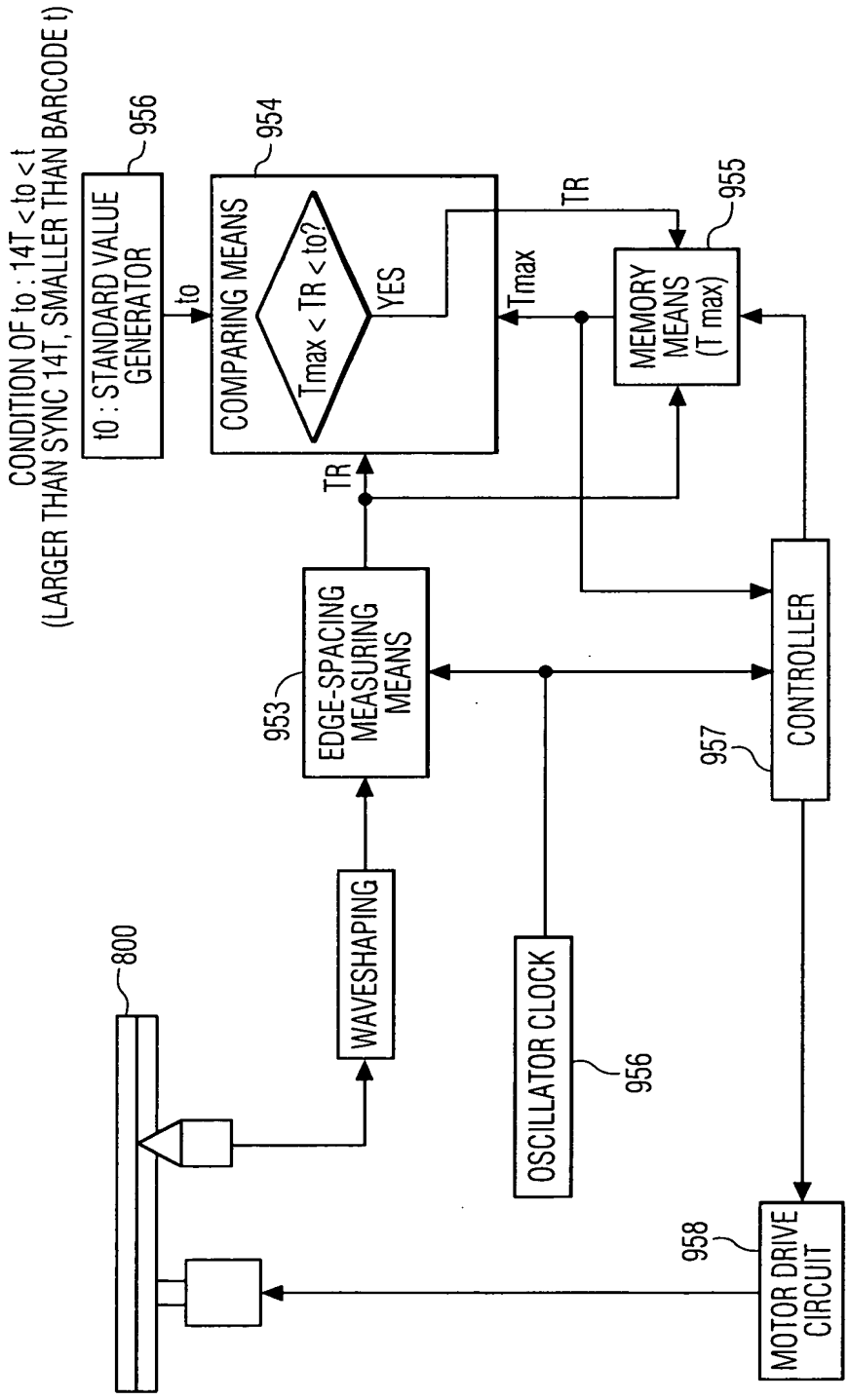

CONDITION OF to : 14T < to < t
(LARGER THAN SYNC 14T, SMALLER THAN BARCODE t)
956
to : STANDARD VALUE GENERATOR
to
954
COMPARING MEANS
Tmax < TR < to?
YES
TR
Tmax
955
MEMORY MEANS (T max)
TR
953
EDGE-SPACING MEASURING MEANS
957
CONTROLLER
800
WAVESHAPING
OSCILLATOR CLOCK
956
958
MOTOR DRIVE CIRCUIT

FIG. 41

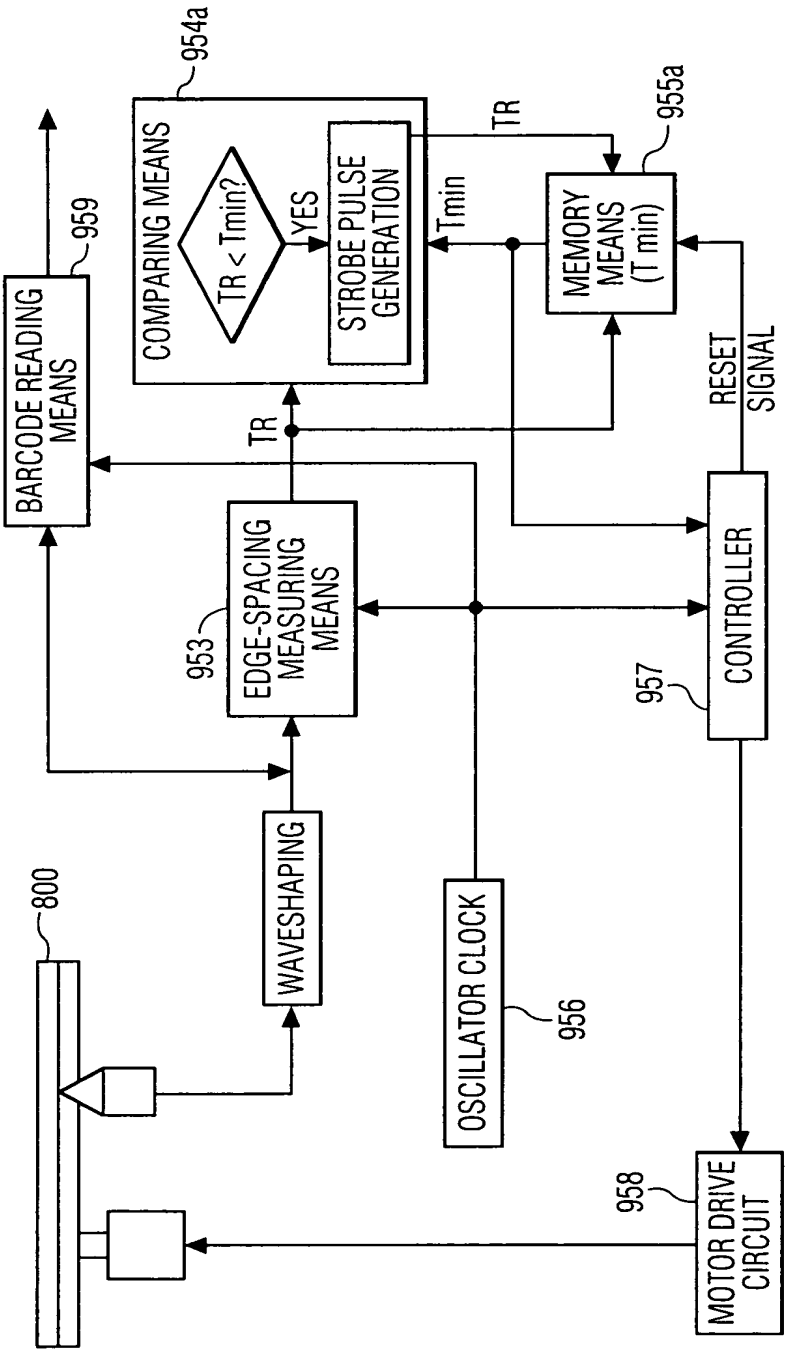

954a
COMPARING MEANS
TR < Tmin?
YES
STROBE PULSE GENERATION
TR
Tmin
955a
MEMORY MEANS (T min)
959
BARCODE READING MEANS
TR
RESET SIGNAL
953
EDGE-SPACING MEASURING MEANS
957
CONTROLLER
800
WAVESHAPING
OSCILLATOR CLOCK
956
958
MOTOR DRIVE CIRCUIT

FIG. 42

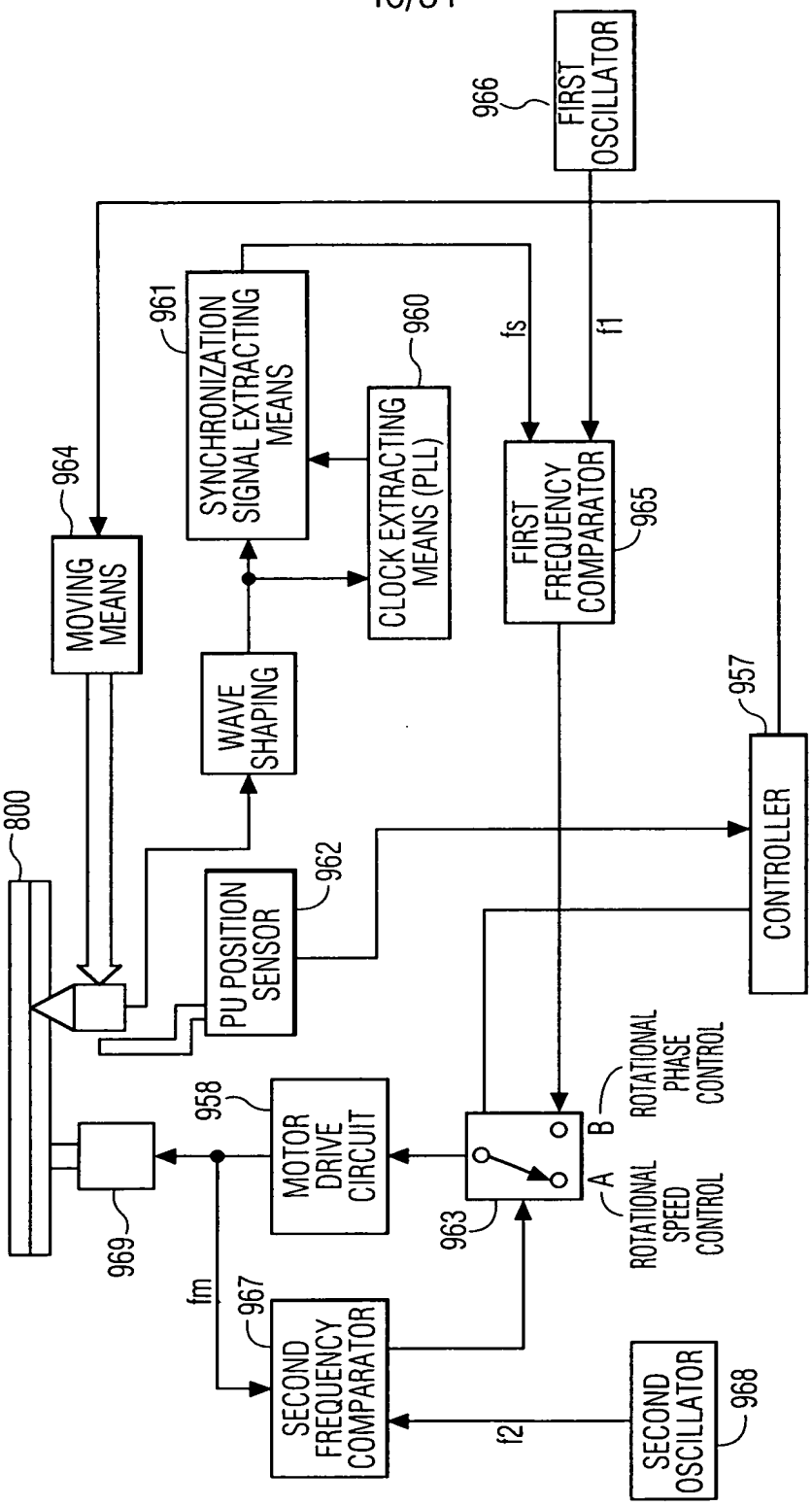

966
FIRST OSCILLATOR
961
SYNCHRONIZATION SIGNAL EXTRACTING MEANS
960
CLOCK EXTRACTING MEANS (PLL)
fs
f1
964
MOVING MEANS
FIRST FREQUENCY COMPARATOR
965
WAVE SHAPING
957
CONTROLLER
800
962
PU POSITION SENSOR
958
MOTOR DRIVE CIRCUIT
ROTATIONAL PHASE CONTROL
B
A
ROTATIONAL SPEED CONTROL
963
969
fm
967
SECOND FREQUENCY COMPARATOR
f2
SECOND OSCILLATOR
968

FIG. 43

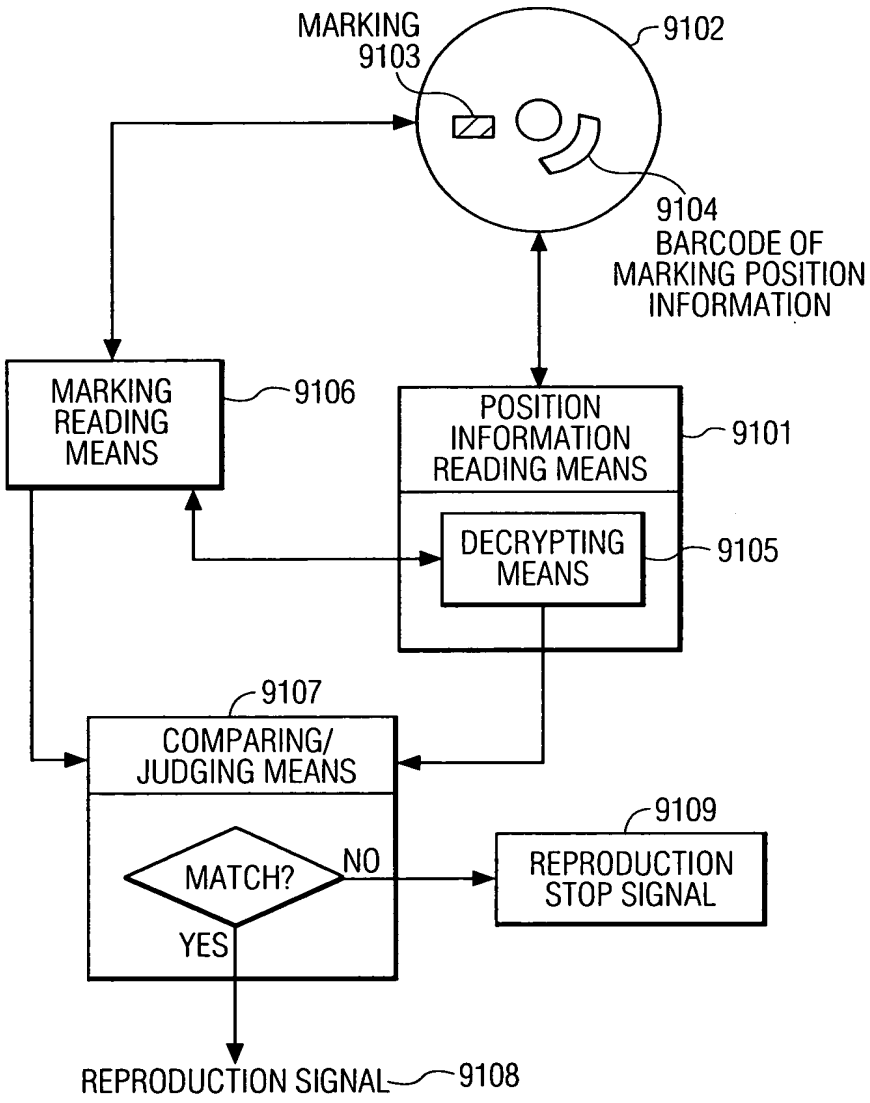

MARKING
9103
9102
9104
BARCODE OF
MARKING POSITION
INFORMATION
MARKING
READING
MEANS
9106
POSITION
INFORMATION
READING MEANS
9101
DECRYPTING
MEANS
9105
9107
COMPARING/
JUDGING MEANS
9109
MATCH?
NO
REPRODUCTION
STOP SIGNAL
YES
REPRODUCTION SIGNAL
9108

FIG. 44

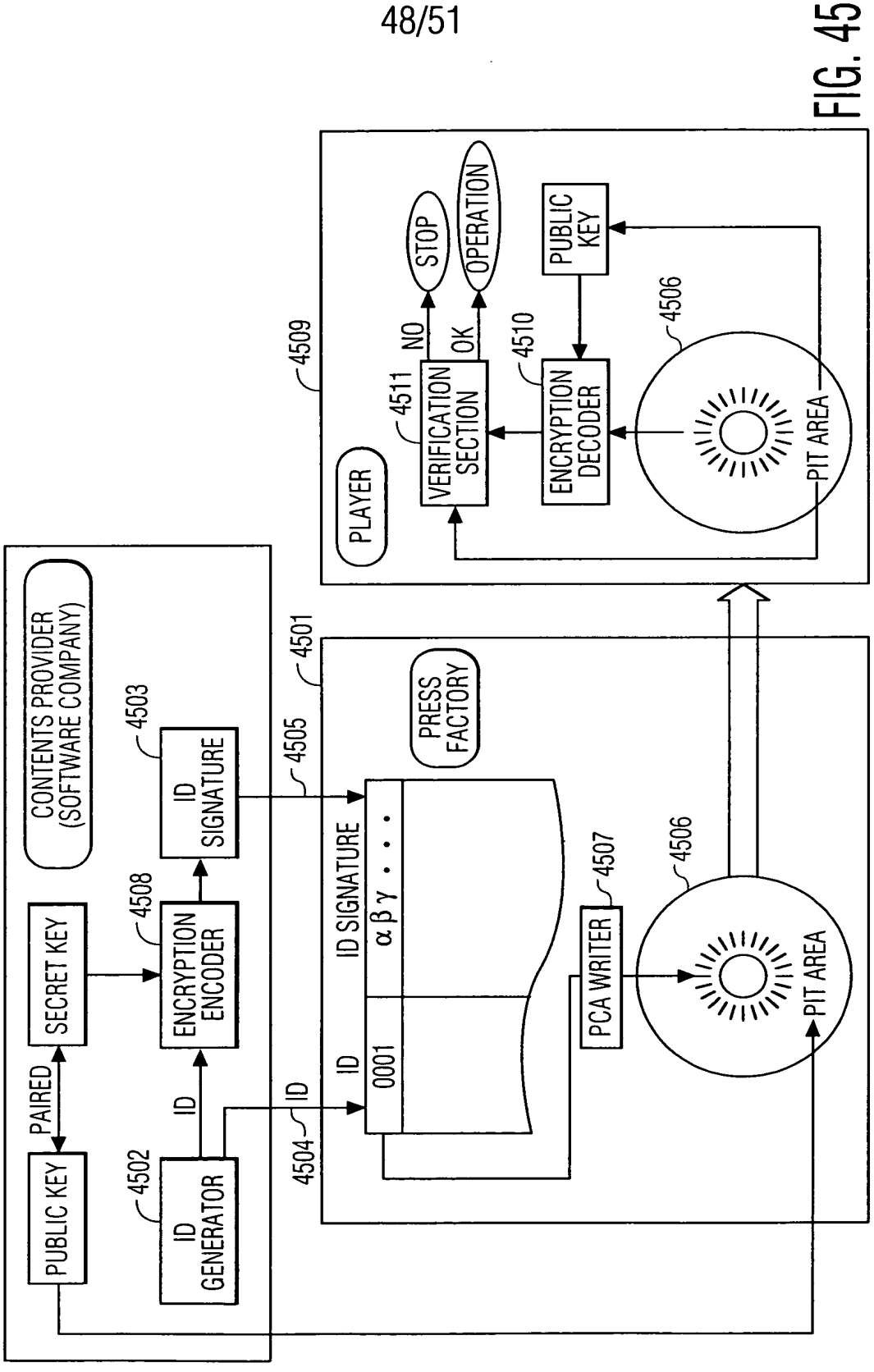

CONTENTS PROVIDER (SOFTWARE COMPANY)
PUBLIC KEY
PAIRED
SECRET KEY
ID GENERATOR
4502
ENCRYPTION ENCODER
4508
ID
ID SIGNATURE
4503
4505
ID
4504
PRESS FACTORY
4501
ID SIGNATURE
ID
0001
α β γ . . .
PCA WRITER
4507
4506
PIT AREA
4509
PLAYER
VERIFICATION SECTION
4511
NO
OK
STOP
OPERATION
ENCRYPTION DECODER
4510
PUBLIC KEY
4506
PIT AREA

FIG. 45

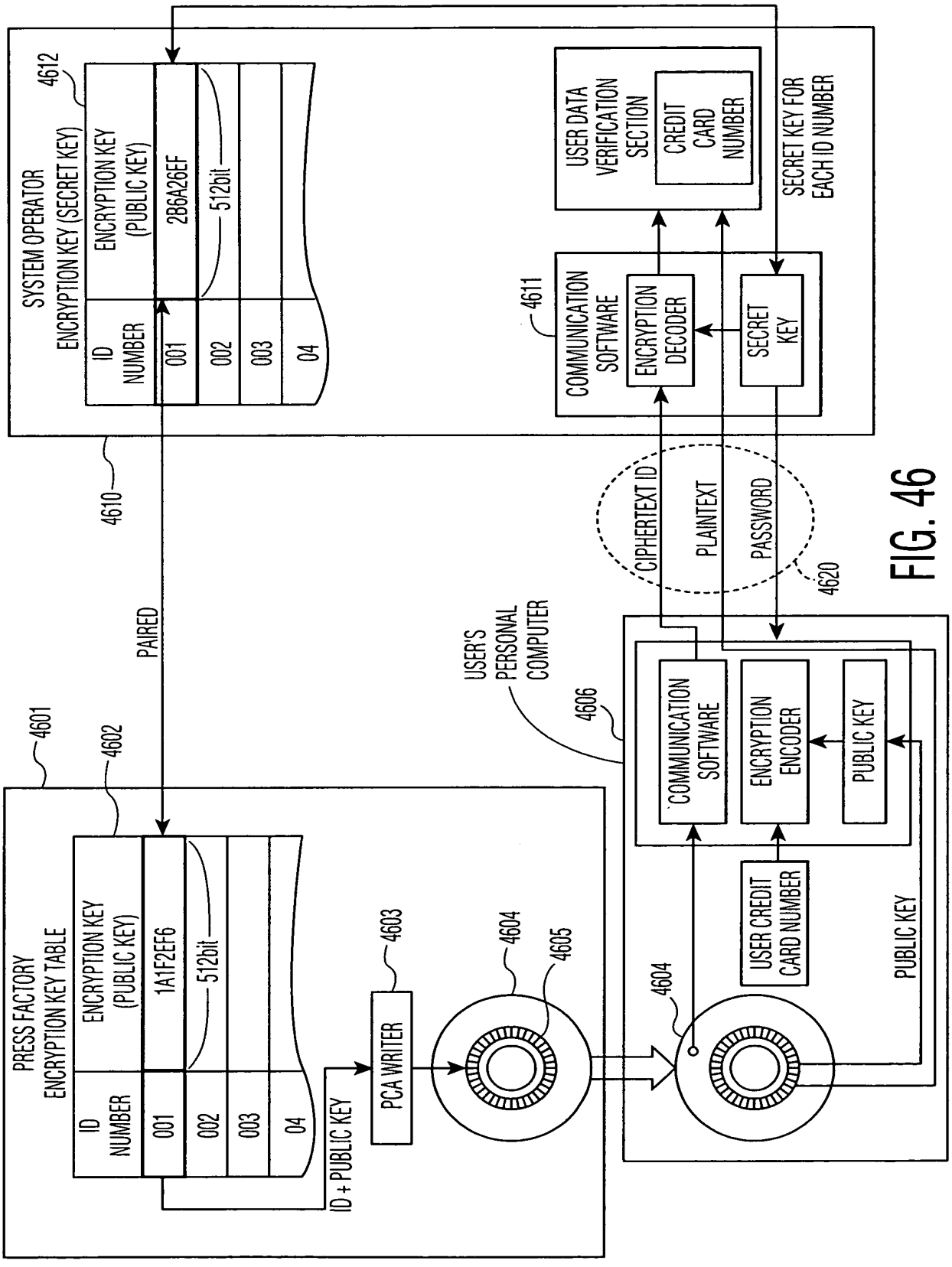

SYSTEM OPERATOR
4612
ENCRYPTION KEY (SECRET KEY)
ENCRYPTION KEY (PUBLIC KEY)
ID NUMBER
001
002
003
04
2B6A26EF
512bit
4610
PAIRED
4611
COMMUNICATION SOFTWARE
ENCRYPTION DECODER
SECRET KEY
USER DATA VERIFICATION SECTION
CREDIT CARD NUMBER
SECRET KEY FOR EACH ID NUMBER
CIPHERTEXT ID
PLAINTEXT
PASSWORD
4620
USER'S PERSONAL COMPUTER
4606
COMMUNICATION SOFTWARE
ENCRYPTION ENCODER
PUBLIC KEY
USER CREDIT CARD NUMBER
PUBLIC KEY
4601
4602
PRESS FACTORY
ENCRYPTION KEY TABLE
ENCRYPTION KEY (PUBLIC KEY)
ID NUMBER
001
002
003
04
1A1F2EF6
512bit
ID + PUBLIC KEY
4603
PCA WRITER
4604
4605
4604

FIG. 46

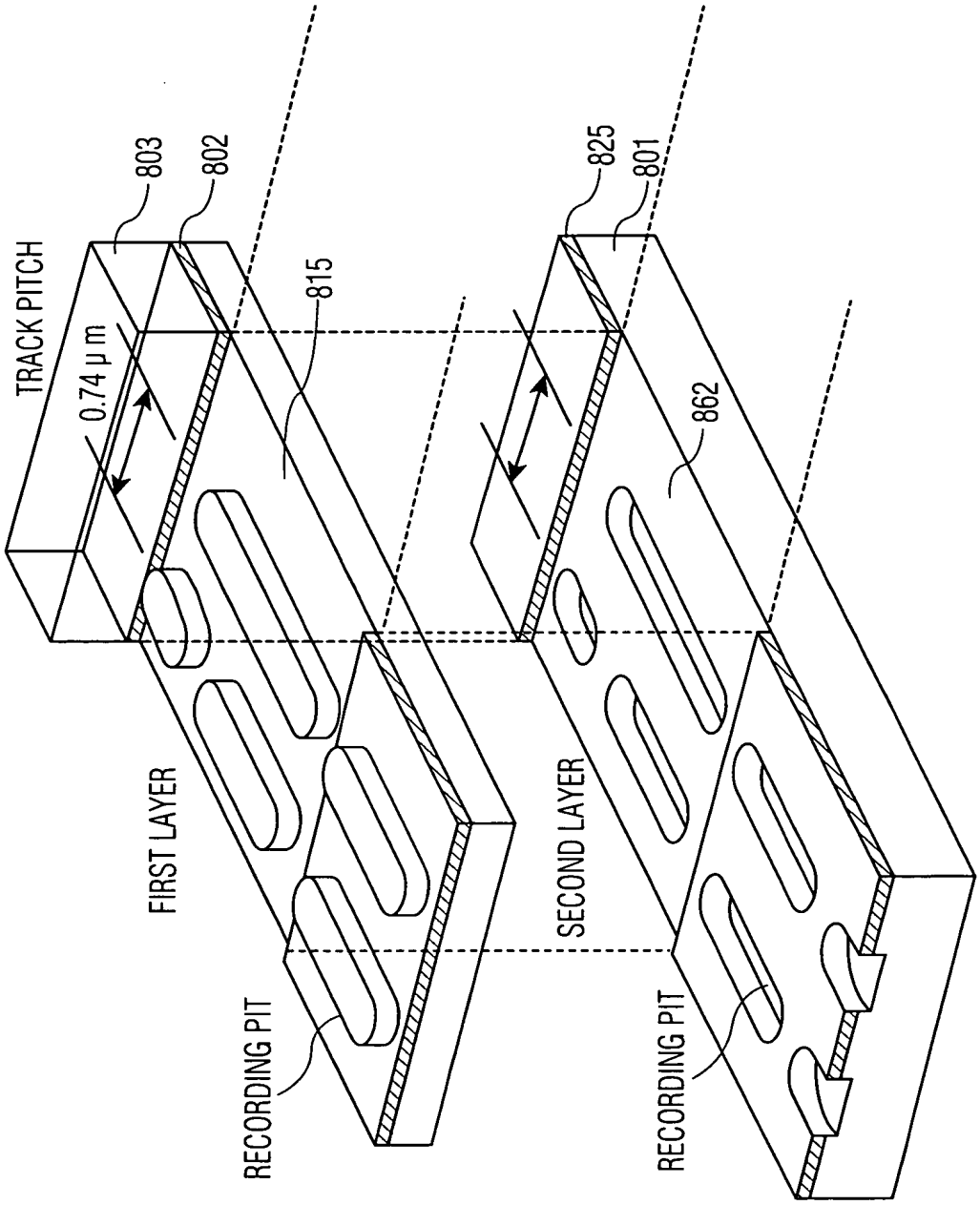

TRACK PITCH
0.74 μ m
803
802
815
825
801
862
FIRST LAYER
SECOND LAYER
RECORDING PIT
RECORDING PIT

FIG. 47

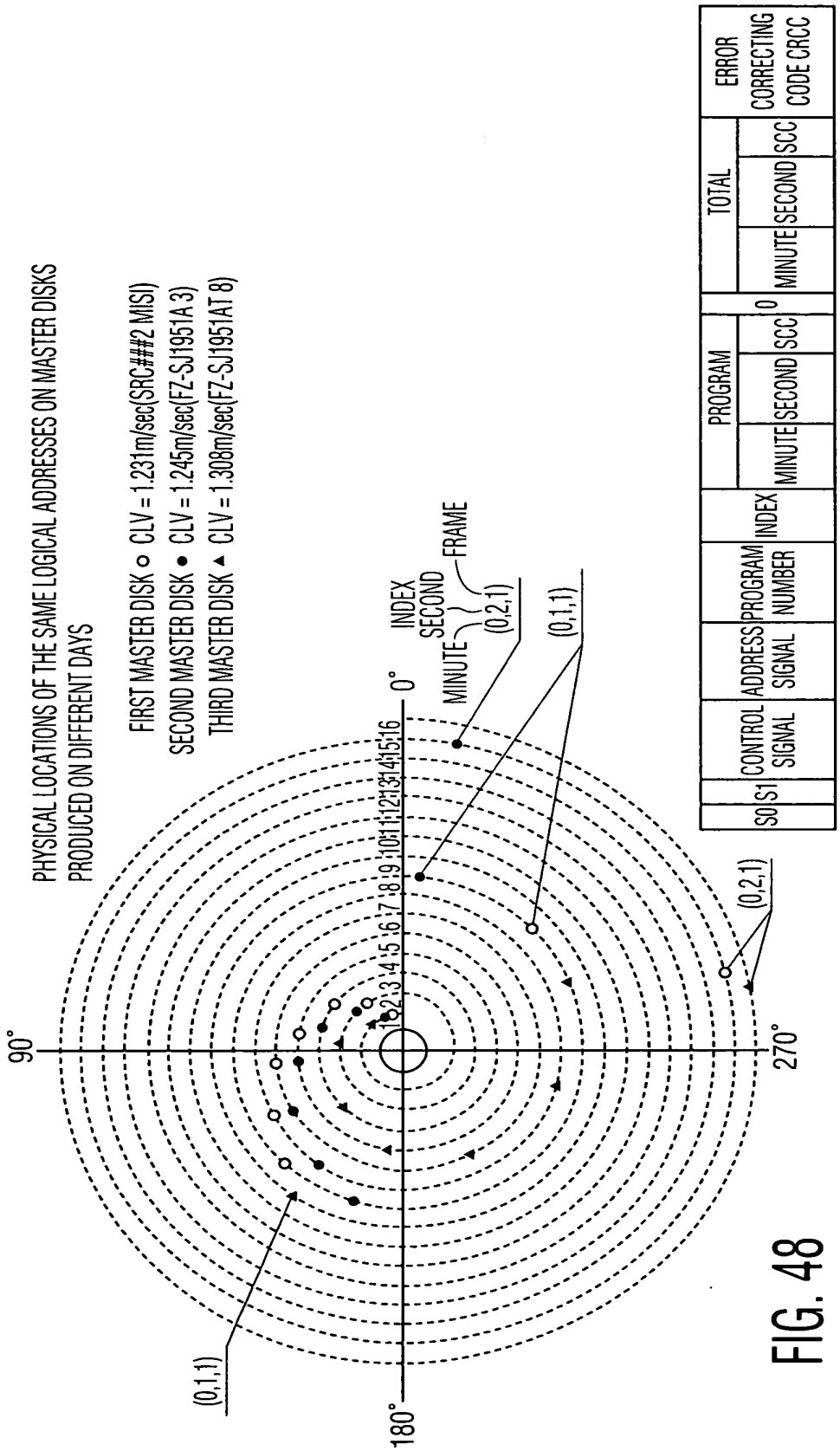

PHYSICAL LOCATIONS OF THE SAME LOGICAL ADDRESSES ON MASTER DISKS PRODUCED ON DIFFERENT DAYS
FIRST MASTER DISK o CLV = 1.231m/sec(SRC###2 MISI)
SECOND MASTER DISK • CLV = 1.245m/sec(FZ-SJ1951A 3)
THIRD MASTER DISK ▲ CLV = 1.308m/sec(FZ-SJ1951AT 8)
90°
0°
180°
270°
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
INDEX
SECOND
MINUTE
FRAME
(0,2,1)
(0,1,1)
(0,2,1)
(0,1,1)
S0 S1
CONTROL SIGNAL
ADDRESS SIGNAL
PROGRAM NUMBER
INDEX
PROGRAM
MINUTE SECOND SCC
0
TOTAL
MINUTE SECOND SCC
ERROR CORRECTING CODE CRCC

FIG. 48